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ABSTRACT

This module, one in a series of performance-based teacher education learning packages, focuses on skills that vocational educators and other occupational trainers need to teach successfully at the secondary and postsecondary levels. The purpose stated for the module is to help educators become competent in organizing the vocational laboratory. Introductory material provides terminal and enabling objectives, necessary resources, and general information. The main portion of the module includes three learning experiences based on the enabling objectives. Each of the first two learning experiences includes educational activities with information sheets or forms and evaluation materials. Optional activities are also provided. Completion of the first two learning experiences should lead to achievement of the terminal objective in the final learning experience, which provides for organizing the vocational laboratory in an actual teaching situation. A teacher performance assessment form is included. (YLB)

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ED222751

Organize the Vocational Laboratory

Second Edition

U.S. DEPARTMENT OF EDUCATION
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FOREWORD

This module is one of a series of 127 performance-based teacher education (PBTE) learning packages focusing upon specific professional competencies of vocational teachers. The competencies upon which these modules are based were identified and verified through research as being important to successful vocational teaching at both the secondary and postsecondary levels of instruction. The modules are suitable for the preparation of teachers and other occupational trainers in all occupational areas.

Each module provides learning experiences that integrate theory and application; each culminates with criterion-referenced assessment of the teacher's (instructor's, trainer's) performance of the specified competency. The materials are designed for use by teachers-in-training working individually or in groups under the direction and with the assistance of teacher educators or others acting as resource persons. Resource persons should be skilled in the teacher competencies being developed and should be thoroughly oriented to PBTE concepts and procedures before using these materials.

The design of the materials provides considerable flexibility for planning and conducting performance-based training programs for preservice and inservice teachers, as well as business-industry-labor trainers, to meet a wide variety of individual needs and interests. The materials are intended for use by universities and colleges, state departments of education, postsecondary institutions, local education agencies, and others responsible for the professional development of vocational teachers and other occupational trainers.

The PBTE curriculum packages in Categories A – J are products of a sustained research and development effort by the National Center's Program for Professional Development for Vocational Education. Many individuals, institutions, and agencies participated with the National Center and have made contributions to the systematic development, testing, revision, and refinement of these very significant training materials. Calvin J. Cotrell directed the vocational teacher competency research study upon which these modules are based and also directed the curriculum development effort from 1971 – 1972. Curtis R. Finch provided leadership for the program from 1972 – 1974. Over 40 teacher educators provided input in development of initial versions of the modules; over 2,000 teachers and 300 resource persons in 20 universities, colleges, and postsecondary institutions used the materials and provided feedback to the National Center for revisions and refinement.

Early versions of the materials were developed by the National Center in cooperation with the vocational teacher education faculties at Oregon State University and at the University of Missouri – Columbia. Preliminary testing of the materials was conducted at Oregon State University, Temple University, and the University of Missouri – Columbia.

Following preliminary testing, major revision of all materials was performed by National Center staff, with the assistance of numerous consultants and visiting scholars from throughout the country.

Advanced testing of the materials was carried out with assistance of the vocational teacher educators and students of Central Washington State College; Colorado State University; Ferris State College, Michigan; Florida State University; Holland College, P.E.I., Canada; Oklahoma State University; Rutgers University, New Jersey; State University College at Buffalo, New York; Temple University, Pennsylvania; University of Arizona; University of Michigan–Flint; University of Minnesota–Twin Cities; University of Nebraska–Lincoln; University of Northern Colorado; University of Pittsburgh, Pennsylvania; University of Tennessee; University of Vermont; and Utah State University.

The first published edition of the modules found widespread use nationwide and in many other countries of the world. User feedback from such extensive use, as well as the passage of time, called for the updating of the content, resources, and illustrations of the original materials. Furthermore, three new categories (K–M) have been added to the series, covering the areas of serving students with special/exceptional needs, improving students' basic and personal skills, and implementing competency-based education. This addition required the articulation of content among the original modules and those of the new categories.

Recognition is extended to the following individuals for their roles in the revision of the original materials: Lois G. Harrington, Catherine C. King-Fitch and Michael E. Wonacott, Program Associates, for revision of content and resources; Cheryl M. Lowry, Research Specialist, for illustration specifications; and Barbara Shea for art work. Special recognition is extended to George W. Smith Jr. , Art Director at AAVIM, for supervision of the module production process.

Robert E. Taylor
Executive Director
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Vocational Education

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION
THE OHIO STATE UNIVERSITY
1960 KENNY ROAD • COLUMBUS, OHIO 43210

The National Center for Research in Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The National Center fulfills its mission by:

- Generating knowledge through research.
- Developing educational programs and products.
- Evaluating individual program needs and outcomes.
- Providing information for national planning and policy.
- Installing educational programs and products.
- Operating information systems and services.
- Conducting leadership development and training programs.

AAVIM
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FOR VOCATIONAL
INSTRUCTIONAL MATERIALS
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The American Association for Vocational Instructional Materials (AAVIM) is a nonprofit national institute.

The institute is a cooperative effort of universities, colleges and divisions of vocational and technical education in the United States and Canada to provide for excellence in instructional materials.

Direction is given by a representative from each of the states, provinces and territories. AAVIM also works closely with teacher organizations, government agencies and industry.

INTRODUCTION

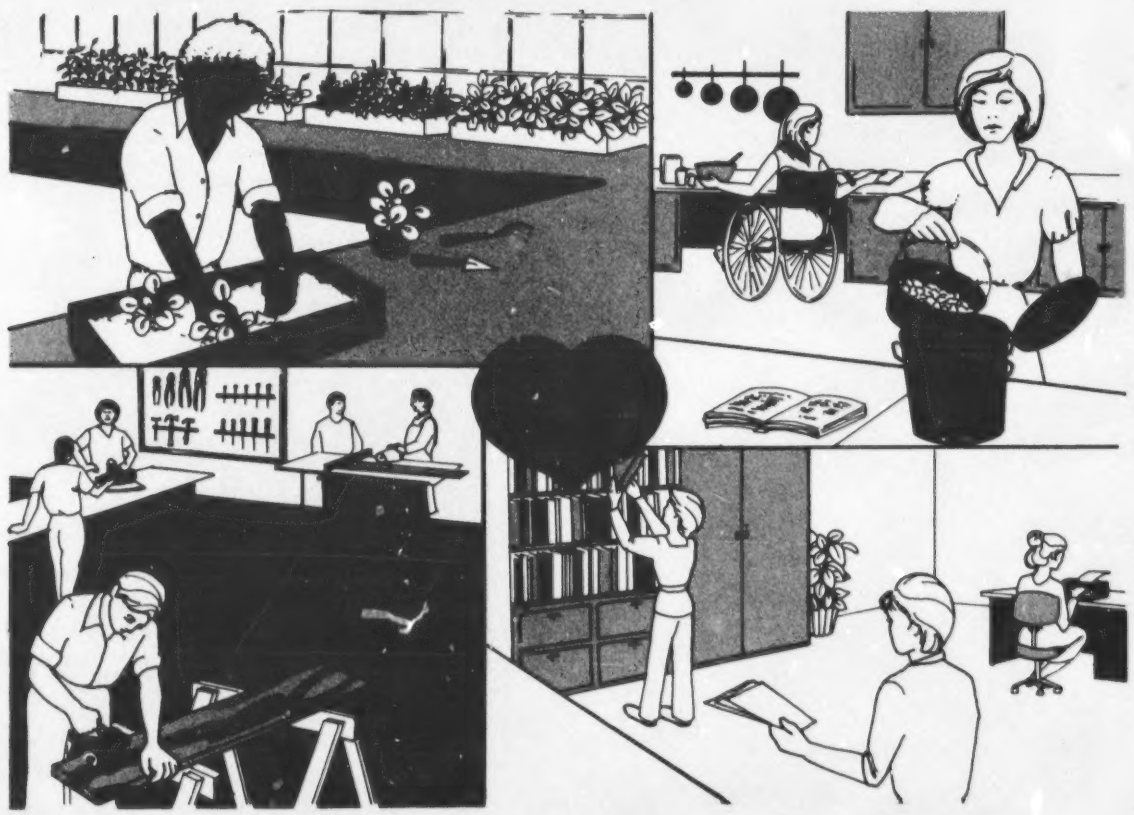
Vocational laboratories are often the teacher's pride, a showplace for the school, and a pleasure for the students to work in. In many programs, the laboratory—and the work that goes on there—is the very heart of the program. In the laboratory, students can experience success, prove themselves, and be rewarded with tangible results.

Laboratories are also expensive to build and equip and difficult to maintain. Teachers of laboratory subjects typically spend a great deal of their time and energy in organizing and maintaining the laboratory for which they are responsible. Therefore, the vocational laboratory must be carefully planned and organized if it is to facilitate instruction, permit teacher and students to work efficiently, provide safety for students and security for equipment and supplies, and justify its cost.

As a vocational instructor, you may be involved in organizing the laboratory in a number of ways. You may participate in the design of entirely new facilities. More often, however, you will need to reorganize or modernize an existing laboratory. Perhaps you may simply need to take stock of your laboratory at regular intervals to make sure that it still provides the environment for instruction for which it was intended. In any case, you will need to know the basic principles common to all laboratory planning and be able to apply them in organizing a laboratory in your specific vocational or technical area.

In this module, the term *laboratory* refers to the facility in a vocational program where the action learning or manipulative activities take place. In some programs, it may also be called a shop, workroom, or office. Whatever the name, the concept is the same, and the same principles of planning and organizing apply.

This module is designed to help you become competent in **organizing** the vocational laboratory. This broad term includes such things as planning, designing, arranging, setting up, remodeling, renovating, and expanding the learning facility. A subsequent module (E-9) deals with the day-to-day management, operation, and maintenance of the vocational laboratory.



ABOUT THIS MODULE

Objectives

Enabling Objectives:

1. After completing the required reading, demonstrate knowledge of the principles and procedures involved in organizing a vocational laboratory (*Learning Experience I*).
2. Given an actual vocational laboratory in your occupational specialty, evaluate the organization of the laboratory and develop plans for its improvement (*Learning Experience II*).

Resources

A list of the outside resources that supplement those contained within the module follows. Check with your resource person (1) to determine the availability and the location of these resources, (2) to locate additional references in your occupational specialty, and (3) to get assistance in setting up activities with peers or observations of skilled teachers, if necessary. Your resource person may also be contacted if you have difficulty with directions or in assessing your progress at any time.

Learning Experience I

Required

Reference: Occupational Safety and Health Standards, Code of Federal Regulations, Title 29, Part 1910, Labor, Chapter XVII. Washington, DC: Occupational Safety and Health Administration, latest edition.

Optional

Reference: Storm, George. *Managing the Occupational Education Laboratory.* Ann Arbor, MI: Prakken Publications, 1979.

Reference: Wahl, Ray. *A Safety and Health Guide for Vocational Educators. Incorporating Requirements of the Occupational Safety and Health Act of 1970, Relevant Pennsylvania Requirements, with Particular Emphasis for Those Concerned with Cooperative Education and Work Study Programs.* Harrisburg, PA: Pennsylvania Department of Education, Bureau of Vocational and Technical Education, 1977. ED 142 708

Learning Experience II

Required

A vocational laboratory in your occupational specialty that you can visit and evaluate.

A resource person to evaluate your plans for improving the laboratory.

Optional

Vocational journals and periodicals that you can review for ideas for organizing the vocational laboratory.

Learning Experience III

Required

An actual teaching situation in which you can organize the vocational laboratory.

A resource person to assess your competency in organizing the vocational laboratory.

General Information

For information about the general organization of each performance-based teacher education (PBTE) module, general procedures for its use, and terminology that is common to all the modules, see About Using the National Center's PBTE Modules on the inside back cover. For more in-depth information on how to use the modules in teacher/trainer education programs, you may wish to refer to three related documents:

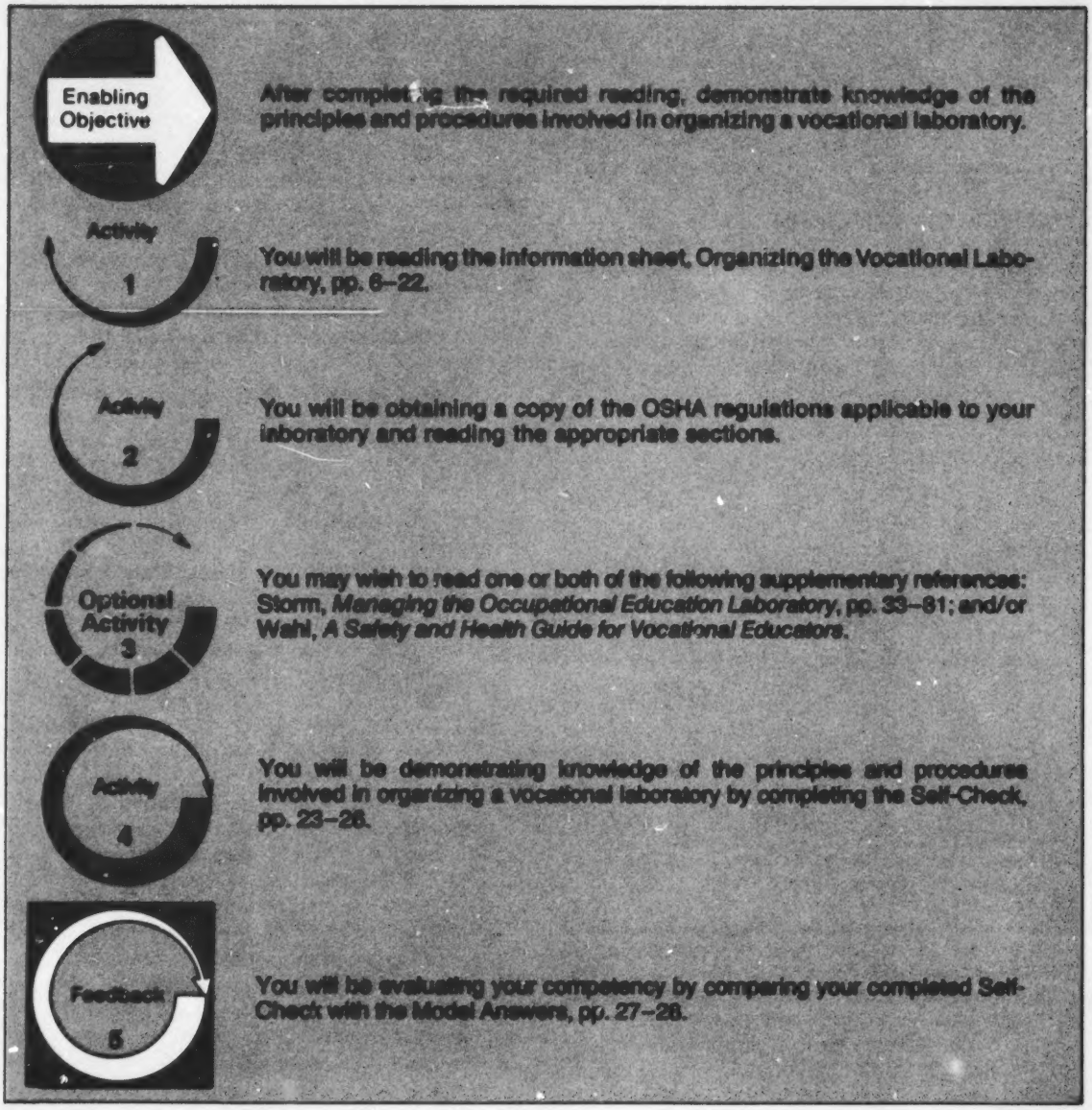
The *Student Guide to Using Performance-Based Teacher Education Materials* is designed to help orient preservice and inservice teachers and occupational trainers to PBTE in general and to the PBTE materials.

The *Resource Person Guide to Using Performance-Based Teacher Education Materials* can help prospective resource persons to guide and assist preservice and inservice teachers and occupational trainers in the development of professional teaching competencies through use of the PBTE modules. It also includes lists of all the module competencies, as well as a listing of the supplementary resources and the addresses where they can be obtained.

The *Guide to the Implementation of Performance-Based Teacher Education* is designed to help those who will administer the PBTE program. It contains answers to implementation questions, possible solutions to problems, and alternative courses of action.

Learning Experience I

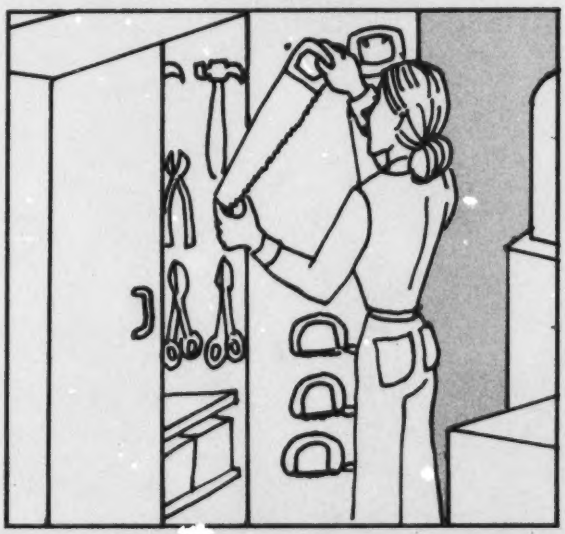
OVERVIEW


Enabling Objective
After completing the required reading, demonstrate knowledge of the principles and procedures involved in organizing a vocational laboratory.
Activity 1
You will be reading the information sheet, Organizing the Vocational Laboratory, pp. 6–22.
Activity 2
You will be obtaining a copy of the OSHA regulations applicable to your laboratory and reading the appropriate sections.
Optional Activity 3
You may wish to read one or both of the following supplementary references: Storm, *Managing the Occupational Education Laboratory*, pp. 33–61; and/or Wahl, *A Safety and Health Guide for Vocational Educators*.
Activity 4
You will be demonstrating knowledge of the principles and procedures involved in organizing a vocational laboratory by completing the Self-Check, pp. 23–26.
Feedback 5
You will be evaluating your competency by comparing your completed Self-Check with the Model Answers, pp. 27–26.

Read the following information sheet about the principles and procedures involved in planning and organizing a vocational laboratory. As you read, attempt to relate the information to the laboratories in your own occupational specialty.

ORGANIZING THE VOCATIONAL LABORATORY

Vocational and technical instructors have a great responsibility that is virtually unknown to most teachers of classroom academic subjects. While the typical classroom teacher may have to care for a few desks, chairs, a chalkboard, and some books, you as a vocational-technical instructor have a large, complex, and expensive laboratory for which you are responsible. The room itself may be specially built. It will very likely contain a number of expensive pieces of equipment, a great many small tools or instruments, and a wide variety of supplies. All of this must be taken care of and used efficiently to help train students for their chosen occupation.



In spite of the work and the difficulties, you can derive a great deal of satisfaction from developing a laboratory that looks good and functions well. Probably no single factor is more important in capturing and maintaining student interest than the quality of the vocational laboratory. In addition, a well-planned and thoroughly organized laboratory makes it much easier to prepare students for the occupation.

The essential purpose of a well-planned and managed laboratory is, plainly enough, to enable students to learn the skills needed in the occupation. The vocational laboratory should **promote** learning. It should make learning a **pleasant** and **satisfying** experience. By simulating occupational conditions, the laboratory prepares students for the real world and, thus, becomes a learning experience itself.

In addition to the primary quality of instructional effectiveness, there are several other important characteristics a well-organized vocational laboratory should possess, including the following:

- It should be **efficient**. Teacher and students should be able to work with maximum productivity and a minimum of wasted time and energy. The most important factor here is the spatial arrangement of tools and equipment.
- It should provide a **safe and healthful environment** in which to work. Students should be able to complete the program in at least as good a physical condition as when they entered. The laboratory must provide good lighting, proper ventilation, a minimum of noise, and safe equipment.
- It should provide for the **psychological needs** of students. The environment should be one that fosters desirable attitudes and promotes mental well-being. It should present a feeling of order, security, and pleasantness so as to promote the desire to learn. Depending on the needs of the occupation, the laboratory can suggest the qualities of accuracy and precision, quiet efficiency, or stylish beauty.
- It should permit the teacher to be in **control** of laboratory activities at **all** times. This means that the teacher should have **lines of sight** to all parts of the room, should be able to **hear** the equipment in operation, and should have quick **access** to all areas.
- It should provide access to instruction for **all** students. This specifically includes students with handicaps, as well as students with other exceptional needs.[1]
- It should provide **security** for the instruments, tools, equipment, and supplies that are essential to the laboratory. The laboratory must be designed to minimize loss or damage from vandalism, theft, mishandling, weather, and other negative elements.

1. To gain skill in providing a laboratory that is accessible to all students, you may wish to refer to Module L-5, *Modify the Learning Environment for Exceptional Students*.

- It should be as **visually pleasing** as the activities permit. Light, color, texture, pattern, and space all contribute to the effect. A laboratory can be a place of stimulation and excitement and certainly need not be one of confusion or dullness.

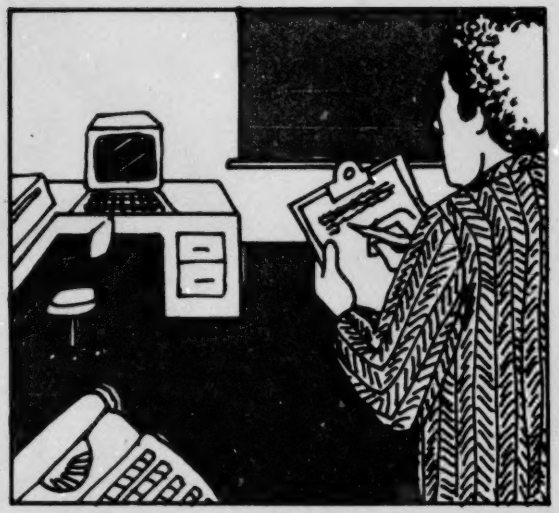
This is quite a large order, but a great many laboratories do manage to meet it, and others could be brought closer to the ideal by the cooperative efforts of the vocational teacher and the school administration.

The first phase of work in achieving all the qualities of an instructionally effective laboratory is that of **planning** and **organizing** the facility. This includes (1) the design or plan of the space itself and (2) plans for the provision of services such as illumination, electrical service, ventilation, and plumbing. It also includes the arrangement of major equipment and furniture in the work space and the detailed planning of such things as storage, safety, and color.

You may be involved in the planning phase of laboratory organization in several ways. In some cases, you may be a member of a planning group charged with designing an entirely new vocational laboratory. The group may be composed of instructors, an educational facilities specialist, a school administrator, and an architect. Together, you would work out the basic requirements of a facility for an expanded vocational program or the vocational wing of a new building.

You may need to draw on your technical and teaching expertise in the process of writing the educational specifications, designing the floor plan, specifying tools and equipment, and checking the final working drawings. Because vocational teachers are only infrequently concerned with drawing and planning new laboratories, these skills are not emphasized in this module.

It is more likely, however, for a vocational instructor to be hired for a teaching position and assigned to work in an existing laboratory. If this is the case, one of the first things to be done is to make a careful evaluation of the laboratory, document any deficiencies, and draw up a plan for improvement. Depending on conditions, the needed improvements may involve some remodeling of the building, repair or refurbishing of the facilities, or rearrangement of the major components within the laboratory. If you are making tentative plans to update your program by adding a new technical operation or an important piece of equipment, you will also need to go through this planning process.



It is highly desirable that, at regular intervals of a year or two, you make a complete evaluation of the laboratory and take all possible steps to correct any poor conditions. This is not as simple or as routine as it may appear. It is all too easy to become accustomed to bad ventilation and deteriorating lighting, for example, and not even be aware of it. Teacher and students alike learn to step around a hole in the floor and put up with a storage room with insufficient shelving. A laboratory that was a model of excellence ten years ago may be made woefully inadequate by changes in technology or school population, but the changes may have been so gradual that they passed unnoticed.

You will need, therefore, to make the necessary effort to **plan** for improvement, make the appropriate people **aware** of the needs of the laboratory, and **follow up** on the request for **change**. It is certainly your urgent responsibility (both moral and legal) to notify the school administration of any conditions in the laboratory that seriously hamper instruction or pose a threat to the safety and well-being of the students.

Even in a situation in which your authority is limited, there is still much that can be done to make the laboratory an efficient place in which to work and learn. You usually can control the lighting, rearrange furniture and tools, and organize the storage of materials.

You may find it worthwhile to invest your personal time and effort in improving your laboratory by installing shelving, constructing tool panels, painting walls and equipment, or making draperies. While such work cannot be considered a recognized professional obligation, it may pay great dividends in terms of teacher and student satisfaction.

The size, shape, content, and organization of vocational laboratories vary widely, depending to a great extent on the nature of the occupation for which students are being prepared. A home economics cooking laboratory, an office machines laboratory, a horticulture potting shed, and an aircraft engine shop are very different from each other indeed. Regardless of the area of preparation, however, there are many common considerations in the planning and organization of the laboratory area.

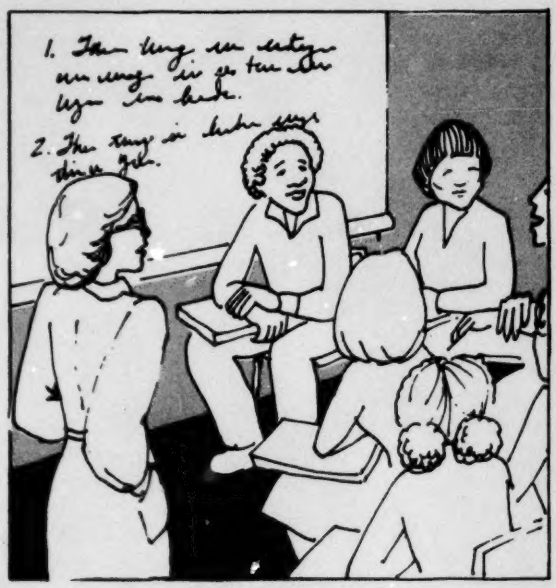
It is important to remember that, in planning and organizing any laboratory facility, you must take the long-term view. Other teachers will be working in the laboratory in years to come, so the design must be based on recognized principles and not personal preferences. Chalkboards should not be installed near the floor just because the present teacher is shorter than average. Machines should not be painted red and blue simply because a teacher wants to display the school colors.

Often, **students** can be of considerable help in organizing a laboratory. They work in it daily and are almost directly affected by its benefits or deficiencies. By closely observing students at work, you may be able to see where they are wasting time or operating inefficiently. Students are usually quite creative in the art of finding shortcuts, avoiding unnecessary effort, and overcoming difficulties.

Through class discussion, you should be able to get many specific complaints about the present laboratory facilities, and you may also receive some valuable suggestions. If it is approached as something that will benefit them, students are often enthusiastic about participating in a plan for laboratory improvement. They can do such things as help move equipment, install shelving, reorganize the storage of materials, or even paint the machines.

Another factor in laboratory organization, which is sometimes overlooked even by seasoned school administrators, is approval by the appropriate **professional accrediting agency**. In certain fields (nurses training, for example), there are specific laboratory standards that must be met if the program is to be fully accredited. As an instructor, you should obtain a copy of the accreditation standards and work with your administrator to make sure your laboratory is properly housed, organized, and equipped.

In other occupational areas, you can get valuable assistance from your **occupational advisory committee**. Members can be asked to make a close inspection of the laboratory and to draw up recommendations for improvement.



Educational Factors in Laboratory Planning

Plans for providing for the students, equipment, and supplies in the laboratory must be continually tested against some basic assumptions, principles, and practices of the vocational program. Not only should the laboratory be educationally sound for the present program, it should be able to accommodate program changes in the foreseeable future as smoothly as possible. It is important that, as planning and organization progress, the following factors be kept constantly in mind.

The laboratory must foster the **long-range goals** and **specific objectives** of the vocational program. If a goal is "to provide more access to vocational education for handicapped students," the laboratory should be planned to avoid obstacles for wheelchairs, provide wide aisles, permit operation of machines while seated, and so on.

If a specific objective is "to train students in microwave cooking," then the proper equipment and space must be incorporated in the laboratory to do the job. Such planning assumes, of course, that the goals and objectives have been clearly formulated and written down. If this has not been done, it should be accomplished before any more planning proceeds.

The **units, lessons,** and **learning activities** that are the content of the program will help determine the equipment to be included in the laboratory and the space required. Course outlines, unit plans, and competency lists thus become important source materials for laboratory planning.

The **number of students** to be scheduled in the laboratory at any one time, their **age**, and their **educational level** are factors in laboratory organization. A facility planned for 24 beginning students in electricity may not be suitable for 15 adults in a course in color television service.

Probably the most important educational factor affecting the organization of the vocational laboratory is that of the teaching methods and approach to be used. Teaching methods govern the amount and kinds of space needed, the amount of duplicate equipment required, and the way in which the facilities are organized. As you examine the laboratory to determine its adequacy and efficiency, you should have a clear idea of the appropriate methods to be used for the subject matter to be taught. Then you can compare the facilities with the methods. Some broad guidelines for this evaluation follow.

Class **lectures** require either a separate classroom, or tablet-arm chairs in the laboratory itself, which take up a great deal of valuable space. Sometimes folding risers can be used so that after lectures the space can be used for project building. Good acoustic conditions for intelligible speech are necessary. A demonstration table, chalkboard, and projection screen will usually also be needed.

Small-group instruction and **demonstration** may take place around a conference table in a small and comfortable seating area, or around a piece of equipment. Major pieces of equipment may need more than the usual workspace around them to allow you to talk to a small group of students as some technical process proceeds. For example, in a dental auxiliary program, the dental chairs should be spaced for group observation and instruction. In a drafting program, one large drafting table can be set aside for group instruction and be provided with generous viewing space around it.

The **project approach** may need unusually large working and storage spaces. Building trades programs may need extensive floor space, free of equipment, in which to construct building sections. In mild climates, outdoor work areas (perhaps protected by a roof) provide inexpensive workspace. Exposure to the weather may provide students with some realistic occupational conditions. Bulky projects that require storage while they are underway (e.g., refinishing furniture) may present special problems, requiring secure storerooms or balcony areas.

If the laboratory revolves around **live work** for customers (e.g., cosmetology), there should be a pleasant and comfortable customer waiting area somewhat separate from the laboratory proper. Live work involving such things as automobiles and television sets requires secure and protected storage of the customers' property.

Individualized vocational programs may need fewer duplicate tools and equipment because it is less likely that all students will be doing the same thing at the same time. The individualized program, however, will probably require individual study areas in the laboratory and several filing cabinets for storing learning packages.[2]

Instruction through the **use of visual materials** also occurs in most laboratories. To facilitate this, a pull-down screen should be installed in front of the instruction seating, and any windows in the area should be equipped with opaque curtains so the room may be completely darkened. Having a cabinet in the laboratory for storing projectors and films is very helpful.

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2. To gain skill in planning laboratory facilities for competency-based programs, you may wish to refer to Module K-3, *Organize Your Class and Lab to Install CBE.*

Techniques of Planning

Sooner or later in the laboratory planning process, you will need to put your ideas down on paper in some graphic form. It is far easier to visualize what the laboratory will look like if you can work from a drawing, sketch, or model than if you just have a vague mental picture of what you want to accomplish.

If you are trying to communicate your plans to others, it is essential that you have a graphic representation to show them. Even when you want to do some minor rearrangement, it is a lot more convenient to change some lines on a sketch than it is to move around a large piece of equipment, trying to find a place in which it will fit.

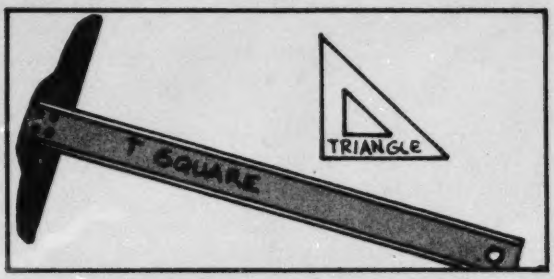
A **sketch plan** is probably the simplest and best way to get your ideas down on paper. A **plan view** is a view of a room or a building drawn as if the room had been sliced through horizontally, about four feet above the floor level, and the top section had been lifted away. Looking straight down at a plan, you can see the outer walls and inner partitions with their windows and doors. You can also see low cabinets, machines or other equipment on the floor, and major pieces of furniture. (See sample 1.)

On the plan, you can indicate with symbols the electrical outlets and plumbing fixtures if this is important to your planning. Simple bold lines are all that are needed, and even a fairly crude sketch plan is better than no drawing at all.

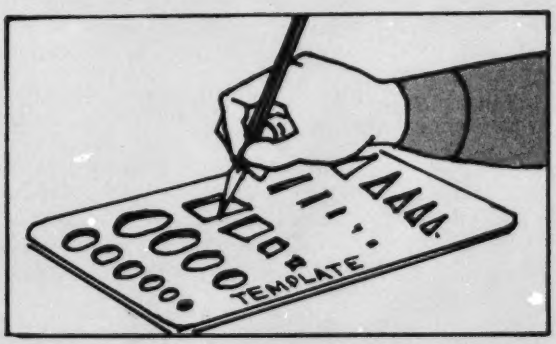
To be most helpful to you, the plan view should be drawn to scale; that is, the drawing on paper should be in proportion to the actual room. You can do this by using a ruler and letting a fraction of an inch on the drawing represent a foot in the real laboratory (½ inch equals 1 foot is a convenient scale).

Another technique to use is to do the drawing on graph paper that is already ruled in small squares. You can let the side of each square represent one foot, or six inches, or some other convenient measure. It is relatively easy then to draw the main features of the room and equipment using heavy pencil lines, either freehand or with a straightedge.

In order to make any scale drawing of an existing laboratory, you will, of course, need to know the dimensions of the room. A measuring tape (50 feet or 100 feet in length) is very helpful to have for this purpose, but a yardstick will do.



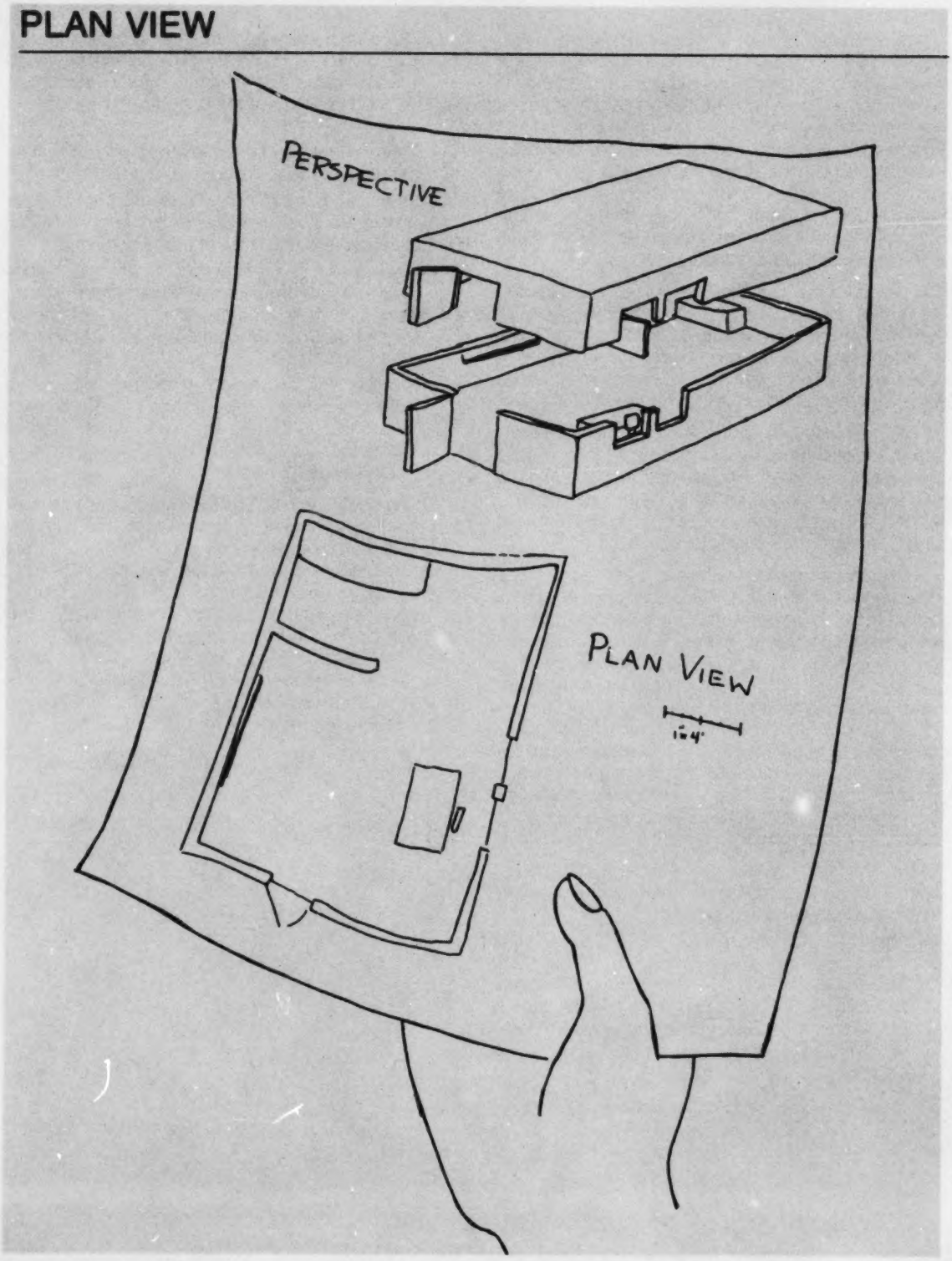
There are several other useful devices to help you to make good sketch plans. A T square and triangle will help you draw vertical and horizontal lines neatly and accurately. Plastic templates (patterns), available from art supply and book stores, make it easy to draw standard shapes such as circles, squares, and rectangles to represent laboratory features and equipment. If you want to experiment with different machine or furniture arrangements, you can cut pieces of heavy cardboard or illustration board in scale to represent the equipment. You can then move the pieces around on the plan to arrive at the best arrangement.



For even more fun, make simple scale models of equipment out of clay or cut them from large bars of soap. Then use them to help you visualize your laboratory organization ideas. The soap model doesn't have to look exactly like a dental chair or printing press; it just needs to have the same proportions and general shape.

SAMPLE 1

PLAN VIEW



Instructional Resource Center

Contemporary vocational curricula are moving toward more individualization, greater responsibility of the student for his/her own education, and packaged or modularized instructional materials. This means that the vocational laboratory should be planned and organized to facilitate such activities. The instructional and study areas should, thus, be an integral part of the laboratory. Or they should be in such close proximity that students can move freely back and forth among the study, conference, and skills areas as the learning experiences require.

An instructional resource center (or learning center) is the place where students may conveniently work on the cognitive (knowledge) aspects of laboratory learning. It is a place to read, view, or listen to instructional media individually; consult reference material; solve technical problems; draw; and write.

From the resource center, the student can quickly go to the skills area to verify the study by testing out a process, using an instrument, or operating a machine. If a problem arises or more knowledge is needed, it is a simple matter for the student to move back to the resource center for further study.

There are some advantages to locating the vocational resource center outside the laboratory in a central location where it may be shared by several occupational programs. However, a resource center right within the laboratory can be of greater benefit to students. It is close to the laboratory equipment, and the teacher is immediately available to provide help and direction. Most existing vocational laboratories can be made to accommodate a resource center by rearranging the facilities and adding some furniture suitable for study activities. A resource center within the laboratory need not be large or extensive, but it should be well planned.

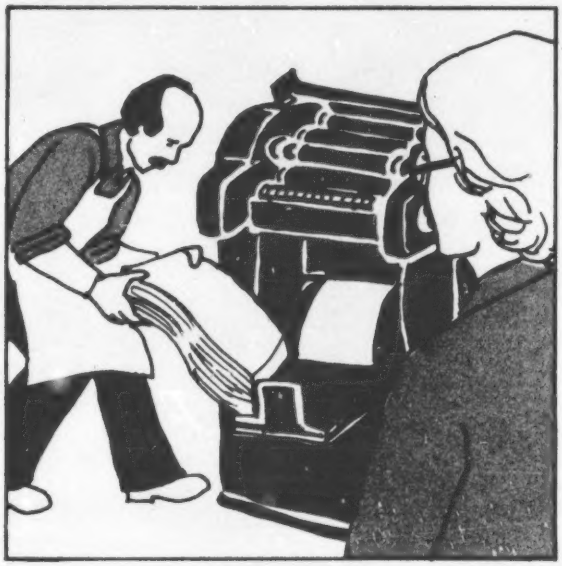
The following are some recommendations for organizing and equipping an instructional resource center in a vocational laboratory:

- The area selected should be out of the main laboratory traffic patterns, reasonably quiet, and easily accessible to the teacher to allow him/her to check on student progress and to answer questions. It is best to isolate the area with some kind of semi-divider (perhaps a countertop cabinet).
- There should be generous general illumination and attractive colors to provide a stimulating atmosphere. If possible, a carpeted floor should be used to enhance the appearance and control noise.
- There should be study space to accommodate about 25 percent of the class at any one time.
- Small study tables and adjacent bookshelves should be provided. Better yet are individual study carrels with a built-in shelf and light.
- More and more instructional materials include media. A fully developed resource center should have a cassette tape player with headphones, a filmstrip and/or slide projector, and a videotape player, if possible.
- Storage for the media materials may be in the form of a lockable storage cabinet or open "pigeonhole" boxes. In either case, storage needs to be organized to permit easy access to the desired material.

The resource center can be a specially remodeled area of the laboratory, complete with new furniture and complex media devices. Or, it can be a simple affair made up of standard school equipment that has been begged, borrowed, or bartered for the purpose. In laboratories where operating conditions are often noisy or dusty, the resource center may need to be completely enclosed, but this is generally not desirable. Most vocational laboratory teachers should be able to reorganize their facilities to be able to provide this valuable learning area for their students.

Simulating Occupational Conditions

Wherever it is possible, the vocational laboratory should reflect occupational standards and actual conditions in the working world. A realistic school laboratory can more effectively prepare students for the job, minimize the adjustments needed as the student enters the occupation, and create positive associations between working and learning. To reorganize a laboratory so that it more accurately simulates real-world conditions, you can draw on your personal occupational experience. You can also go out into the field to observe present conditions and practices in shops, offices, or stores. In addition, your occupational advisory committee can give you up-to-date information about how you might reorganize your laboratory.



School laboratories can be made to simulate occupational conditions in the following ways:

- Select the same types of equipment as used in the occupation, in terms of size and capability, function, and mode of operation. Having outmoded equipment or special school-type, light-duty machinery makes it difficult for students to learn present occupational practice.
- Use materials and supplies comparable with those used in the occupation. In industrial drafting rooms, for example, use tracing films; do not have students do their work on manilla paper.
- Arrange machines and equipment in patterns similar to those on the job. If cooking pots are hung above the range in a commercial kitchen, the food service laboratory can use a similar arrangement, even if it detracts somewhat from a neat appearance.
- Create an atmosphere similar to that in the occupation by sensitive selection of color schemes, furnishings, and room arrangements. A child-care laboratory can seem like the best of day-care centers, and a food service area can simulate an attractive cafe with flowers on the tables and piped-in music.

Simulation can, of course, be carried too far. There is no point in simulating dirty or disorganized working conditions, even if such conditions exist in the occupation. The school laboratory is designed for different objectives than shops in business and industry. The laboratory's prime function is that of instruction, while the shop's purpose is that of production. A dental assistant's laboratory the size of a dentist's office would accommodate only a few students. An aircraft mechanics laboratory designed to duplicate a service bay for a Boeing 747 would be unfeasible, to say the least. You should attempt simulation, guided by your common sense.

Laboratory Arrangement

Not only must a vocational laboratory be well equipped, but the equipment must be placed in an arrangement that will allow work to go on efficiently, conveniently, safely, and pleasantly. Even instructors in existing laboratories have opportunities to improve the facility by doing some minor or major reorganization. Though the recommendations and requirements for laboratory arrangements will vary with the specific occupational area, there are a number of general principles that hold true for any facility.

Most laboratories are rectangular in shape, usually about twice as long as they are wide. This is an efficient design, relatively easy to organize, and effective in operation. There should be at least two doors—for student safety as well as convenience in accepting service and deliveries. Ideally, there should be no columns or other structural members to obstruct the floor area.

There should be an adequate amount of space in the laboratory to provide for the expected laboratory activities and the number of students enrolled. The definition of *adequate* varies greatly with the occupational program. Light work confined to a desk or worktable may require as little as 30 square feet per student. With a class of 20 students, this would mean you would need about 600 square feet, or a laboratory space (not including storage) 18 feet wide and 34 feet long.

For laboratories where moderately active work takes place (e.g., typewriter repair), about 50 square feet per student is required. Heavy work (e.g., mine equipment maintenance) may require 100 or more square feet for each student. Some programs may require additional outdoor space (e.g., an outdoor play area for a child-care program or a fenced area for vehicle storage in a automotive services program).

For some recommended laboratory spaces, see sample 2. By calculating the actual area (length multiplied by width) of your laboratory and dividing that figure by the maximum number of students that will be using the laboratory at any one time, you can determine the actual square footage available per student. This figure can be compared with the recommended standards of square feet per student.

Students and teachers usually move around a great deal in a laboratory. They move from one machine to another, carry stock, get tools and instruments, and move their job to a workbench. These typical movements create patterns, called **traffic patterns**, that should be taken into consideration in organizing the laboratory. You should anticipate the traffic patterns and place tools and equipment so that the following criteria are met:

- Wide lanes are provided for major traffic.
- Students can move to get tools or stock without disrupting others' work.
- Travel distances between major work stations and to supply areas are as short as possible.
- You can travel in relatively straight lines to be at hazard areas quickly.
- The path from danger areas (e.g., metal casting) to exits is short and clear.
- Long materials (e.g., lumber) can be carried from supply rack to work place without turning sharp corners and endangering students.

Well-planned walk space and short traffic patterns can be significant factors in (1) conserving your energy as you move about the laboratory, (2) making the work progress efficiently, with as little wasted time as possible, (3) providing a safe working environment for students, and (4) preventing unnecessary disruptions and discipline problems among students.

Somewhat related to traffic patterns are **sight lines**. Ideally, when you are working in the laboratory, you should be able to see all activity areas from any spot in the room. This permits you to observe every student at work and to take action to correct unsafe situations or see which students need help.

It is not always possible, of course, to have clear sight lines to every area of the laboratory. For example, the teacher of photography will not be able to see what is developing in the darkroom from other areas of the laboratory. In order to maintain reasonable sight lines in the laboratory, the following planning guidelines should be used:

- Plan the laboratory for a simple rectangular shape; avoid L shapes or separate rooms.
- Eliminate posts, columns, or other structural members; if they can't be eliminated, keep them as small as possible.
- Do not construct dividers, partitions, or tool panels in places where they will obstruct the view, though open dividers may be satisfactory.
- Large pieces of equipment or storage cabinets should be placed against a wall where they will not be an obstruction.

Not only should you be able to see what is going on in all parts of the laboratory, but you should be able to **hear** as well. A machine giving off the wrong sound because it is malfunctioning or being improperly operated should catch your attention instantly. In some situations (e.g., role-playing activities in distributive education), it is important for you to hear comments and responses between students as they work together. Generally, if extraneous noise is con-

SAMPLE 2

RECOMMENDED LABORATORY SPACE FOR SELECTED OCCUPATIONAL PROGRAMS

Occupation	Square Feet Per Student	Percentage of Additional Storage	Number of Students
Accounting	30–35	10–15	18–24
Appliance Service	130–150	20	16–22
Auto Body or Mechanic	180–250	10–20	16–22
Building Trades	125–150	20	16–22
Business Machine Service	50–70	15	16–22
Cabinet & Carpentry	125–150	20	16–22
Child Care	60–85	15	15–20
Commercial Art	50–70	15	16–22
Cosmetology	80–125	10	16–22
Drafting	55–80	5	20–26
Electricity or Electronics	50–70	10	16–22
Graphic Arts	80–125	15	16–22
Marketing	45–75	10–15	20–24
Machinist	130–180	15	16–22
Medical Assistant	95	15	16–22
Needle Trades	70–85	10	15–20
Nursing	85	20	20–24
Sheet Metal	80–115	10	18–22
Typing	25–30	10–15	25–60
Waiter-Waitress	50–65	20	18–22
Welding/Metal Fabrication	130–160	15	18–22

SOURCE: Adapted from George Strom, *Managing the Occupational Education Laboratory* (Belmont, CA: Wadsworth Publishing Co., 1976), pp. 45, 46.
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trolled and good lines of vision prevail, you should be able to hear readily enough.

The **space around each work station** should be adequate for the type of work to be done there. Small, close work (e.g., watch repair) requires very little extra space around the workbench because the job is basically self-contained. Other operations requiring the processing of large-sized materials (e.g., cutting a full 4′ × 8′ sheet of plywood on a table saw) require a great deal of free space surrounding the machine.

Some training programs require a measure of open, unobstructed floor space in which students can work. A training laboratory for paramedics, for example, should have floor space (ideally carpeted) in which students can practice emergency lifesaving procedures on prone, life-sized models.

Some operations should have an unobstructed safety zone in a particular area in case of excessive heat, sparks, or malfunctions. For example, the table saw should have about 20 feet of unused area immediately behind the blade in case a piece of wood is thrown violently backward. An arc-welding area should be located and protected so that the intense light will not harm the eyesight of passersby.

As you figure work space for a particular work station or machine, determine (1) whether more than one person will be working there at the same time, (2) how much space is required for the convenient and safe movement of the student, and (3) the maximum size of the material to be used at the station.

The plan drawings in sample 3 show a basically undesirable L-shaped laboratory area with many built-in problems. Plan I indicates problems of traffic flow, lack of security, and difficulty of teacher control. Plan II shows what might be done with a minimum of effort to improve the situation.

Storage

You need to store many things in your laboratory. Student supplies, materials, small tools, instruments, special equipment, student projects, instructional materials and devices, and school records all must have convenient, safe, and appropriate storage. If storage is inadequate or of the wrong kind, the situation creates problems for you.

There are several things you, as a laboratory teacher, should do about storage needs:

1. Determine the type of items that require storage in your occupational program.
2. Identify the special storage requirements for each of the types of items.
3. Survey the storage facilities available in the existing laboratory for each type of material, and determine the adequacy of the facilities.
4. Prepare plans for improving storage in the laboratory.
5. Implement the plans by changing the storage facilities, or present your needs to the school administration.

Each vocational-technical area has its own particular storage needs and problems. A beginning teacher can identify these special needs by drawing on his/her knowledge and experience in the occupation, by visiting other successful laboratory teachers in the area and discussing common problems, and by reading journals devoted to the subject. Common to all occupational areas, however, is the need for (1) convenient storage to minimize the effort needed to handle and control materials, (2) safety in the storage of hazardous substances, (3) security from damage or unauthorized use, and (4) an adequate amount of storage for present and future use. Following are some specific guidelines for planning laboratory storage facilities.

Storage facilities should be convenient to the service entrance through which materials are delivered and close to the point of their use in the laboratory. It should not be necessary to carry large materials through the working area. It should also be easy for you to locate needed supplies quickly and take inventory of the stock accurately and conveniently.

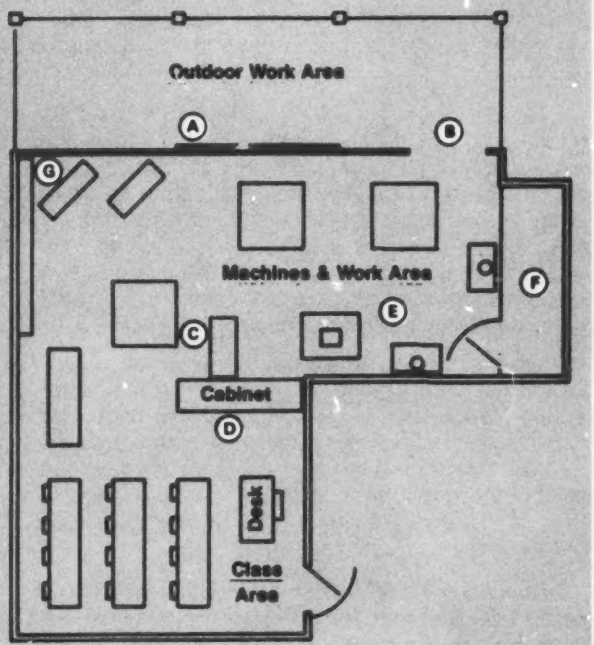
Materials should be visible and organized, not stacked behind each other on shelves or stored in difficult-to-reach places. Storage spaces should be well lighted. A metals supply rack, for example, should be located so the long bars can come straight in the service entrance, and the material should be

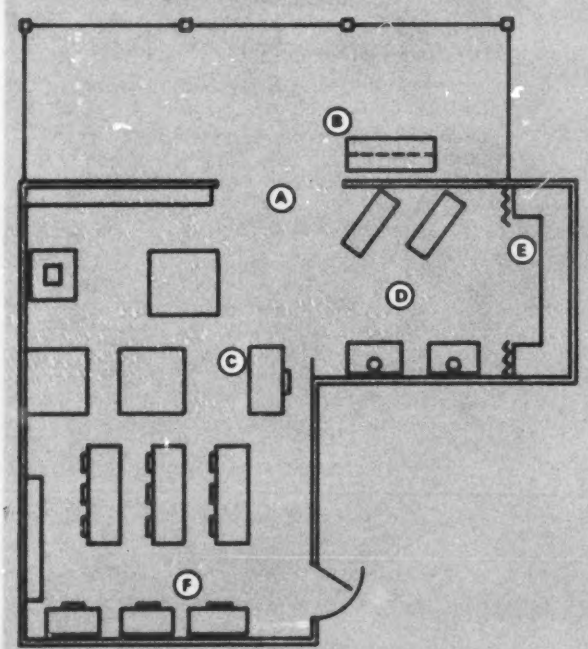
SAMPLE 3

PLAN DRAWINGS

(I) Laboratory Layout Presenting Many Problems of Organization

- (A) Outdoor tool panel lacks security
- (B) Service door small, difficult to monitor
- (C) Traffic lane obstructed
- (D) Cabinet blocks teacher's view
- (E) Machine area out of sight from teacher's station
- (F) Supply room difficult to control
- (G) Storage rack inaccessible





(II) Problems Minimized

- (A) Service door enlarged and relocated for accessibility
- (B) Portable tool panel can be moved into laboratory
- (C) Teacher's station relocated for better control
- (D) More floor space for project work
- (E) Open storage permits better supervision
- (F) Individual study area provided

sorted by type of metal and size so any desired piece can be located quickly.

Many vocational areas use materials and supplies that require specific safe storage conditions. The materials may be flammable, explosive, toxic, corrosive, or have other hazardous characteristics. Examples of these kinds of materials are tanks of welding gases, acids, paints, solvents, and radioactive materials.

Local fire codes involving these kinds of materials must be complied with. Typically, flammable liquids should be stored in a concrete storage room, outside the laboratory proper. The regulations of the Occupational Safety and Health Administration (OSHA) describe the required storage facilities for all such material. Every vocational teacher should obtain a copy of OSHA regulations from the agency's regional office and follow the regulations scrupulously.

Some laboratory materials need to be stored in controlled conditions if they are to maintain their quality and perform properly. Food and photographic film should be stored at fairly low temperatures. Furniture lumber and printing papers need to be stored in conditions of controlled humidity. Cleanliness is a special requirement for storing office supplies and photographic supplies.

Certain drugs and chemicals should be kept in a dark place. Extreme precision tools and equipment (e.g., the gauge blocks used in tool and die making) must be kept at a uniform temperature if they are to function accurately. You will need to determine what materials in your laboratory require such special storage.

It is becoming increasingly important to safeguard materials and supplies from theft, loss, or misuse. Almost all materials in the laboratory are subject to abuse of some kind, but there are particular problems in some vocational areas.

Gold and other precious metals used in a dental technician program need secure storage. In health occupations laboratories, extremely thorough precautions must be taken in the storage of drugs, hypodermic needles, and syringes; these should be controlled as they are controlled in a hospital. Small and valuable electronics parts, valuable metals, and expensive small tools and instruments may also need to be kept in locked storage cabinets.

Central storerooms serving several laboratories, as well as tool rooms located within a single laboratory, are losing favor among vocational teachers. Having tool panels located near the work stations where they will be used is usually much more efficient. If there is a specially designed and designated holder for each tool or instrument, the student can locate it quickly, and you can make a check of the panel conveniently and accurately at the end of the class period. Some tools and instruments, of course, may be too delicate, large, or expensive to be placed on an open panel.

There are several techniques that you may use to get the most out of the storage space that is available in the laboratory, including the following:

- Use the space under workbenches for storage of bulk and sheet materials.
- Store long and light materials (e.g., molding, plastic rods) vertically instead of horizontally.
- Use outdoor space to store weatherproof materials that are needed only infrequently.
- Cut large stock and divide bulk materials into the smaller sizes that will actually be needed by students, storing the small materials on shelves or in cabinets.

The Laboratory Environment

You have direct responsibility for the environmental conditions in the laboratory. It is important that the environment be conducive to student learning and that the laboratory be a safe and healthy place in which to work. The factors that must be considered in planning and providing for a good environment are (1) illumination, (2) atmospheric conditions, (3) acoustics and sound control, and (4) aesthetics and color. Laboratories that are noisy, dark, uncomfortable, or ugly cannot provide the setting necessary for efficient learning or pleasant associations with the work of the occupation.

In some teaching situations, you may have only limited control over these conditions. The custodian may regulate the temperature and room ventilation, while acoustics and room appearance may be integral with the building and difficult to improve. In any case, however, you should check existing conditions, compare them with the ideal, and develop some plan for any needed improvement.

The plan may simply be to document the needs and present them to the school administration (or school evaluation committee) or gradually to seek resources and permission to get the job done. You need to work cooperatively with the custodial staff to be sure that all the service systems are working properly and that the environmental requirements of the laboratory are being met as well as possible. In a time of energy conservation programs, you may need to work closely with your administration to be sure that your program's minimum needs—in terms of lighting, heat, and ventilation—will be met.

Illumination

One basic factor in organizing any vocational laboratory is that of providing proper lighting for the work to be done there. Insufficient or improper illumination can be depressing to students, cause fatigue, be a safety hazard, and lead to errors or poor-quality work. If nothing more, you should be able to maintain reasonable illumination by (1) making sure the lighting system is functioning properly, (2) turning on lights when they are needed, (3) having bulbs and tubes replaced with the appropriate type as needed, and (4) having tubes and fixtures cleaned at regular intervals.

The lighting in the laboratory should be sufficient for the type of work being done. Simple tasks that involve manipulating large objects require only a normal level of illumination, while fine and accurate work requires high-level illumination. There are detailed tables available showing recommended lighting standards for almost all fields of work. If you are interested, you may consult this information. However, the standards are stated in foot-candles, a unit of measure that must be calculated using a light meter. A more general description of lighting needs follows:

Very Low Lighting
- Television viewing
- Storage rooms

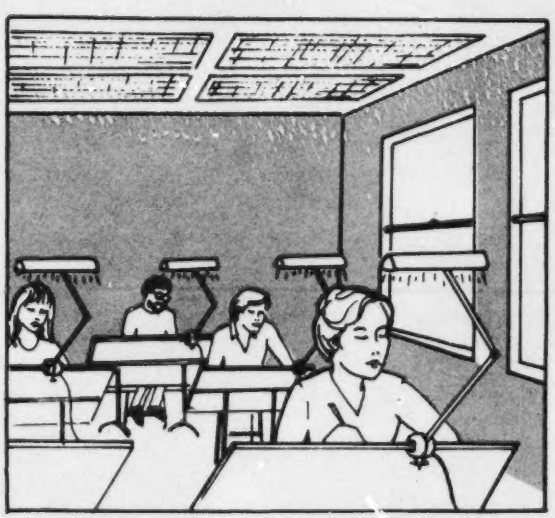
Moderate Lighting
- Waiting lounges
- Conference rooms

Good General Lighting
- Classrooms
- Reading
- Assembly processes

High-Level Lighting
- Drafting
- Sewing
- Inspection

Very Bright Lighting
- Extra-fine assembly
- Color identification
- Very severe visual tasks

The **amount** of light is not the only important factor in providing good lighting; the **quality** of the light should also be considered. Natural light provided by north windows is, in general, excellent, but it is obviously affected by weather conditions and time of day. In addition, recent trends in energy conservation have tended to reduce window sizes. Good general illumination is free of glare and even, with low contrast between the work area and the background. Well-designed fluorescent lighting can provide this.



The color characteristics of the light should be chosen for the type of laboratory. This can be done by selecting the appropriate tube or bulb. Fluorescent lighting tubes, for example, are available in several types that have slightly different color characteristics. The "cool white" type is the kind usually used for general classroom illumination. It has a natural and pleasing balance of white light. "Warm white" is somewhat pinkish in tone, while "daylight" tubes are designed to simulate natural noon light as closely as possible. The common household light bulb (the incandescent bulb) gives a warm light in a concentrated area. Following are some examples of lighting situations:

- Food service areas should use "warm white" fluorescent tubes to make foods (especially meat) look more appetizing.
- Cosmetology laboratories also should use "warm white" light because it makes flesh tones look more appealing.
- Reading and general classroom work should be lighted by "cool white" tubes.
- Colors are most accurately rendered in "cool white" or "daylight" illumination. Textile laboratories, fashion design laboratories, and graphic arts shops should have "daylight" illumination available.
- Incandescent bulbs can be used to provide an intense spot of light for demanding visual tasks or for displays.
- Special lights may be required for certain technical processes (e.g., orange or red safelights for photographic processing, ultraviolet light for metal inspection, or special fluorescent light for stimulating plant growth).

Atmospheric Environment

Laboratories that are too hot or too cold, are badly ventilated, or have humidity that is too high or too low cause students to be physically uncomfortable and, thus, present a less than ideal environment for learning. In severe conditions, the laboratory environment may actually pose a threat to the health of students and teacher alike. It is your responsibility to see that student health is not jeopardized by potentially harmful dust, exhaust emissions, fumes, or gases that may originate in the laboratory.

The best laboratory atmosphere will be one in which the air is clean, odorless, and free of harmful gases. The air will be continually moving, without sharp drafts. The temperature of the room will be kept at an appropriate level for the activities taking place. The humidity level in the room will be comfortable. In spite of modern heating and cooling systems and specially designed exhaust systems, such an atmosphere is not always easy to achieve. The situation is not helped any by the fact that some vocational laboratories are in quarters not originally planned for them. For example, what may be a satisfactory heating and ventilating system for a standard classroom may be woefully inadequate for an active laboratory.

The optimal temperature for a laboratory will vary with the type of work. Very active, heavy work (e.g., masonry or foundry) may best be done at 65°F. or even lower. Inactive, light, and very accurate work (e.g., watch repair or drafting) requires a temperature about 72°F. Humidity (if it can be regulated at all) should generally be maintained at about 30 percent for maximum comfort and health.

Many laboratories have their own problems of ventilation. The technical processes involved in some occupations produce excessive heat, fumes, and noxious odors that must be removed from the environment as quickly as they occur. The standard practice is to install a metal collector hood over the source area and to use an exhaust fan to vent the fumes to the outside. In the case of dust, a central vacuum system is often used, with inlets placed in several locations in the laboratory and the dust collected in large cloth bags that must be emptied periodically. It is **not** a satisfactory solution to simply disperse the pollutants by moving the air through the laboratory with a circulating fan.

Among the special environmental problems in vocational laboratories are the following:

- Toxic fumes may be irritating, debilitating, or even lethal. They must be removed quickly and thoroughly by exhaust systems. Examples are welding (particularly with some metals such as zinc), photographic and cleaning chemicals, gasoline engine exhaust emissions, and certain adhesives.
- Smoke and particles in the air must not only be removed from the source, but should be filtered out of the air. This problem exists in food preparation, spray painting, and woodworking.
- If it is not already a legal requirement or institutional regulation, cigarette smoking should not be permitted in the vocational laboratory. Smoking can affect the health and safety of all students.
- Excessive heat is usually readily dealt with by simple exhaust systems. This condition often occurs in metal foundry, food preparation, and dry-cleaning laboratories.
- Strong odors, though they may not be hazardous, are very unpleasant and should be controlled before they affect the rest of the school. Removing the source and exhausting the air are the usual remedies.
- Many technical processes require very strictly regulated conditions of temperature and/or humidity. Examples are furniture finishing with lacquers, plant growing areas in ornamental horticulture, and chocolate candy making. Labora-

tories in which these kinds of activities take place must be planned to include the specialized equipment needed to maintain the required environmental conditions (e.g., humidifiers, dehumidifiers, auxiliary heaters, air conditioning and refrigeration equipment or blowers).

Sound Control

When students are actively working and machines are in operation, there is going to be some noise. The crucial concern is to keep the sound at a level that is not fatiguing or harmful and that allows students and teacher to communicate easily and accurately. Since a considerable proportion of instruction is through speech, if students can't hear clearly, they will have difficulty learning.

Continuous loud noise inside the laboratory can be more serious than is usually realized. Common responses to noise are irritability, tension, and inability to concentrate. Prolonged exposure to high noise levels can cause temporary hearing loss and, eventually, permanent damage. This kind of noise is often given off by electrically powered machines such as wood routers, saws, and planers, as well as small gasoline engines.

Machine noise may be controlled by surrounding the motor with fiberglass or similar insulation. Or, it may be controlled by mounting the machine on pads (such as cork) to prevent the noise and vibration from being transmitted to the floor. It may be possible to build an enclosure, covered on the interior with acoustic material, for a noisy machine. In clean laboratory areas, carpeting the floor can bring down the noise level significantly. If noise control can't be built into the laboratory facility, students may have to be required to wear ear-protection devices.

Another sound problem is that of poor acoustics. If sound is reflected by walls and ceiling and reverberation times are long, speech becomes unintelligible. Reverberation is the continuation of the sound after the source has stopped. Hard-surfaced building materials, such as concrete and tile, reflect sound and increase the echos. Carpets, draperies, and acoustically treated ceilings are the standard remedies for reflected sound.

Attractive Environment

It may seem that a vocational laboratory need not be physically attractive as long as it allows the students to learn the skills of the occupation. There are, however, some genuine benefits to having a working environment that is pleasing in its order and proportions, colorful, and varied in materials.

Students should work in a setting that at least meets the standards that apply in the occupation so they become familiar with the setting and associate with it. Learning in surroundings that are attractive generates good feelings and pleasant associations so students will want to continue learning. Careful selection of color can affect students psychologically and can have a beneficial stimulating effect. In your efforts to improve the laboratory, you can organize furniture and equipment to present an ordered appearance, select appropriate colors for walls when the laboratory is periodically repainted, and add simple touches such as plants or posters to enhance an otherwise sterile setting.

Colors, in particular, have an important effect on the appearance of the laboratory. Some colors tend to soothe and relax, others stimulate and excite, while still others depress and irritate. Yellow appears cheerful, reds are stimulating, blue calms and appears cool, and green has pleasant associations with nature.

Applied to a laboratory, lighter colors tend to make the room seem larger, dark colors make it appear smaller. Warm colors (the yellows, browns, and reds) suggest hospitality, friendliness, and security. The cool greens and blues, on the other hand, are associated with efficiency and accuracy. You may create the psychological environment you desire by carefully selecting colors for the various parts of the laboratory.

Laboratory Planning Sequence

You may be an instructor in a new professional position, or you may be ready to add a new instructional area to your vocational program. Or, you may simply want to reevaluate and review the adequacy of your laboratory instruction. You will need to establish a logical sequence of work in order to take all factors into consideration and arrive at a rational laboratory plan. The following is a suggested planning sequence for reorganizing an existing facility:

1. Review the statements of educational goals and objectives for your vocational program.
2. List the learning activities that are to take place in the laboratory.
3. Examine the equipment and supply lists for the projected learning activities.
4. Determine all the major dimensions of the existing facility, including storage rooms, doors, and windows. Use a measuring tape to obtain reasonably accurate measurements.
5. Figure the total square footage of the laboratory, and divide by the anticipated student enrollment to determine the adequacy of the space in terms of square feet per student.
6. On graph paper or using a drawing board, make a plan drawing of outside walls, partitions, and storerooms, drawn to scale. Indicate the location of doors and windows.
7. On the drawing, indicate the other permanently fixed objects in the laboratory (e.g., sinks, counters, very large machines, gas lines, exhaust fans, or hydraulic lifts).
8. Determine the approximate boundaries of each of the desired activity areas to be included in the laboratory.
9. Arrange the furniture and equipment on the plan drawing. Use scaled patterns or models of the equipment. Consider the relationship of the storage of tools and materials, sequence of operations, safety zones, operation space, and traffic lanes. Experiment with many alternative arrangements. When the arrangement has been decided on, draw the outlines of the furniture and equipment on the plan view. Label each piece.
10. Determine the location of auxiliary equipment and facilities (e.g., tool panels, supply racks, chalkboard, or display areas).
11. If applicable, decide on color schemes for walls, equipment, furniture, and carpeting.
12. Prepare a set of notes giving information about the procedures for implementing the laboratory organization plan. This may include any necessary remodeling, additional equipment, new furnishings, painting and cleanup, and moving.
13. Prepare a step-by-step plan for completing the reorganization and improvement of the laboratory.

Obtain a copy of the regulations of the Occupational Safety and Health Administration. This government document, called *Occupational Safety and Health Standards*, should be available to you by writing or telephoning the local area office of OSHA nearest you. The location and number can be found in city telephone directories under U.S. Government, Department of Labor. Copies of this publication are also available in the government documents section of most libraries.

Read the contents page to become familiar with the organization of the document, and then read the sections dealing with the materials or equipment commonly used in your specific vocational laboratory.

For more information on the principles and procedures involved in planning and organizing a vocational laboratory, you may wish to read Storm, *Managing the Occupational Education Laboratory*, pp. 33–81.

In evaluating your vocational facilities for possible improvement, it is very helpful to use a checklist that identifies current safety and health regulations. Such a comprehensive self-inspection checklist is included as Chapter IV in the following supplementary reference: Wahl, *A Safety and Health Guide for Vocational Educators*. Other chapters in this reference that you may wish to read cover the following topics:

- Legal implications of the regulations included in the Occupational Safety and Health Act of 1970
- Applicability of the regulations to school and staff
- Detailed descriptions of the provisions and standards of the regulations
- Definitions, format, guidelines, procedures, and related information needed by the educator to incorporate safety and health into the education program
- List of hazards and standards, along with the source of each
- Lists of related resource materials, agencies, and organizations

The following items check your comprehension of the material in the information sheet, Organizing the Vocational Laboratory, pp. 6–22. Each of the seven items requires a short essay-type response. Please explain fully, but briefly, and make sure you respond to all parts of each item.

SELF-CHECK

1. There are many things to consider when planning your vocational facilities. One of the most important is ensuring that the facilities themselves will meet educational needs and requirements. What does this mean to you as a vocational teacher as you begin planning for improving your own laboratory?

2. Probably few laboratory teachers feel that they have enough space in their laboratories for all the things that need to be done there. How can you determine whether, in your specific program, you have adequate space (if it were used efficiently) or whether you have legitimate grounds for asking your school administration for an addition to your laboratory?

3. What principles of planning should you use to determine the **kinds** of storage space you need in the laboratory for your occupational service area?

4. Perhaps you have heard vocational teachers say, "The ventilation and noise in my laboratory are really bad, but the students and I got used to it after a while and never notice it." Does this statement agree with what you know about good environments for learning? Explain your response.

5. Suppose that in your training program there are at least some operations or processes that involve very concentrated tasks requiring fine or very accurate workmanship. How does this affect the design and organization of your laboratory?

6. If a fellow teacher were having some discipline problems with his or her class, how could this teacher organize the laboratory facility to help minimize the chances of behavior problems occurring?

7. After the students have left for the day, you wander over to the laboratory next to yours for a bit of relaxed conversation. The instructor pushes some papers off a chair and motions for you to sit down while she heats water for tea over a bunsen burner. As you and Daisy Rafferty have your tea together, you mention that you have some ideas for improving your laboratory and are going to read the regulations of the Occupational Safety and Health Administration (OSHA) to be sure that your lab meets their safety requirements.

   Daisy tosses her used tea bag at the wastebasket (and misses), and then replies, "I wouldn't bother about OSHA. That's for industries, not schools—and besides, they'll never come around here to check up, so why should we worry? We can't do anything about these labs anyway—that's the school board's responsibility."

   How would you respond?

Compare your written responses to the self-check items with the model answers given below. Your responses need not exactly duplicate the model responses; however, you should have covered the same **major** points.

MODEL ANSWERS

1. You must remember as you plan your laboratory that the most important concern is that of furthering the instruction of students. The laboratory is not designed for your use or to please the administration. Plans for reorganizing or replanning a vocational laboratory must begin with a clear conception of the goals and objectives of the specific occupational training program. Then planning must be done to make the laboratory help in the achievement of these objectives.

   Another educational requirement that should dictate the nature of the facilities is that of the teaching approach to be used. The laboratory should facilitate the use of the selected instructional methods. The student project method may call for large areas of open floor space, while the competency-based approach should have individual study carrels in the laboratory for student use.

   All aspects of the design and organization of the laboratory should be concerned with the welfare of students and teacher. Anything that hampers learning, such as noise, confusion, or inadequate lighting, should be corrected. Laboratories should help make learning easier and more pleasant—not more difficult. If fulfilling these educational requirements entails the expenditure of money or effort, then these resources should somehow be found.

2. Determining whether or not you have adequate space in your laboratory need not be a matter of guesswork or personal preference. There is a definite procedure that will help, as follows:
   1. Measure the existing laboratory space and determine its major dimensions. Do not include the storage areas.
   2. Calculate the total square footage (area) of the laboratory. In a rectangular room, figure the length times the width, in feet. In an irregularly shaped space, you may have to figure small areas separately and add them all together.
   3. Estimate the maximum number of students that will be enrolled in any one class.
   4. Divide the total square footage of the laboratory by the number of students.
   5. Compare the result with the recommended standards of square feet per student for your specific laboratory subject. (Consult sample 2, p. 15, or the reference given there.)
   6. If the space is adequate, or even generous, consider yourself fortunate. If it is inadequate, take steps to limit enrollment or, much better, to acquire additional space.

3. Not only should a laboratory have **sufficient** storage space, it should also have the right **kinds** of storage for tools, materials, equipment, and projects. As you plan for storage, the first step is to identify all the materials to be used in the program that will require storage of some kind. From this list, it should be possible to identify the special storage conditions that are required, whether this is a matter of security, safety, atmospheric conditions, or size.

   It may be easier to determine the storage needs of the materials than to determine the kinds of storage that will satisfy those needs. You may want to consult OSHA guidelines if the problem is one of storing hazardous materials. It is also helpful to consult the literature of the occupational area, draw on personal experience in industry, or visit other laboratories with exemplary facilities. Other standard references for building construction can also suggest solutions to storage problems.

4. You may become accustomed to conditions, and you may no longer consciously notice the problems, but your body is affected nonetheless. The wrong temperature, poor air quality, or inadequate light tend to create physical and psychological difficulties. Students may suffer loss of interest, tension, depression, or inability to concentrate, and no one may realize that the cause is the environment of the laboratory itself. Excessive noise, for example, may have very definite ill effects even though you claim that you don't hear it anymore.

The quality of the laboratory environment should be assessed on as objective a basis as possible. If necessary, you can measure the light in the room, check the temperature, and measure the humidity. Noise levels (and their effects) and air quality are more difficult to determine, so it may actually help if an outside observer is called in to make an objective evaluation of these conditions. The laboratory environment must be obviously wholesome, not simply tolerable.

5. The requirements for each such demanding task may be somewhat different, but in general there are some design considerations that should be considered. For fine and accurate work, very high light levels are needed, free of glare and with little contrast between the work and background.

   The laboratory area where the demanding tasks are done should be as quiet as possible because noise interferes with concentration. It should also be free of distraction and disruption, so an isolated or separated area may need to be provided. Because the student will be relatively inactive when doing the work, there should be a gently moving flow of air of the right temperature. All of these factors will have to be considered when the laboratory is organized.

6. A poorly organized laboratory may actually be conducive to poor behavior, while a thoughtfully planned one can minimize behavior problems. Reorganizing the laboratory is not likely to change a disruptive group of students into quiet and conscientious workers, but it can help. There are a number of things your fellow teacher can do to the laboratory, as follows:
   - Check that he/she can see student activity in all parts of the room from any place in the room. Remove any obstacles to vision and hearing.
   - Locate his/her desk or work station so that it controls the entrances and exits to the laboratory.
   - Locate tool panels and storage so they are a short distance and in a direct line from work stations to prevent students from disturbing each other as they pass.
   - Design tool panels that can be readily checked. Keep hazardous or valuable items in secure storage.
   - Provide wide aisles and clear walkways so he/she can move quickly to a trouble spot.
   - Control machine noise by padding or insulation. Noise begets more noise, which leads to difficulty in learning.

7. Daisy seems to be grabbing at any excuse to avoid thinking about her laboratory. She needs to understand that the safety guidelines and regulations of the Occupational Safety and Health Administration do indeed apply to school laboratories.

   Up to this time, the major enforcement effort has been in industrial plants, but that is no reason for vocational laboratory instructors to feel complacent about their facilities. It is the responsibility of all vocational teachers to know the local and national safety regulations that apply to their occupations and to make every effort to see to it that their laboratories comply.

   It is important that vocational laboratory facilities be as efficient and safe as they can be. The health and safety of the students (and the teacher) are of paramount concern, and any recommendations that would help to make working in the laboratories safe and pleasant should be investigated.

   Students should also learn what safe working conditions should prevail in their chosen occupations, and they can do that by working in a laboratory that represents a model of excellence. The habits that they acquire in your training program and the lessons they learn about shop organization will stand them in good stead when they have responsibility for their own establishments.

   The OSHA regulations and guidelines can help you to make a strong case to your school or college administration when the opportunity arises to renovate or reorganize the laboratory. The weight of the federal government is behind those regulations, which is hard for any administrator to ignore.

   Your plans for improving the laboratory will have more impact if you can show they are not just the result of personal preferences but are based on the recognized requirements of the occupation. Every vocational teacher is responsible to at least some degree for his or her laboratory and should not pass off that important responsibility to others.

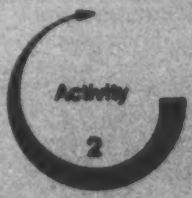
Level of Performance: Your written responses to the self-check items should have covered the same **major** points as the model answers. If you missed some points or have questions about any additional points you made, review the material in the information sheet, Organizing the Vocational Laboratory, pp. 6–22, and in *Occupational Safety and Health Standards*, or check with your resource person if necessary.

Learning Experience II

OVERVIEW

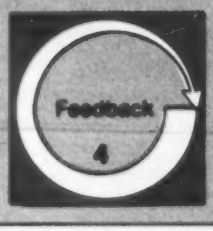
Given an actual vocational laboratory in your occupational specialty, evaluate the organization of the laboratory and develop plans for its improvement.

You will be visiting a vocational laboratory in your occupational specialty and collecting information about the laboratory and its organization.



You will be evaluating the effectiveness of the laboratory organization, using the Vocational Laboratory Observation Checklist, pp. 31–32, and writing a summary report and recommendations for the organization of the laboratory.

You may wish to refer to the journals and periodicals that serve your vocational service area for up-to-date ideas for organizing vocational laboratories.



Your competency in evaluating the organization of a vocational laboratory and developing plans for its improvement will be evaluated by your resource person, using the Laboratory Planning Checklist, pp. 35–36.

Arrange through your resource person to visit a vocational education laboratory that trains students in the basic or beginning courses of your occupational specialty and to observe an ongoing program.

During your visit, note the learning activities taking place, how the students are going about their tasks, and the efficiency with which laboratory work is being accomplished. Obtain the major dimensions of the laboratory and the location of the major fixed items of construction or equipment (e.g., doors, windows, sinks, or exhaust fans) that affect the laboratory arrangement.

If there is no laboratory available to you that is directly concerned with your vocational interests, visit a laboratory that is as closely related as possible.

Using the Vocational Laboratory Observation Checklist, pp. 31–32, examine the laboratory facilities and evaluate each item given on the checklist. Add any items to the checklist that are important to your specific occupational area.

In conducting your observation/evaluation, you need to keep in mind that your evaluation is unofficial. You are a guest of the institution involved, and as such, it is not your place to criticize the facility or dictate actions that should be taken. If the institution's staff wish to have feedback concerning your findings, this should be arranged through your resource person.

Prepare a summary report of your recommendations for improving each area of the laboratory facilities. Be specific and positive in your statements. Limit your comments to the planning and organization of the **facilities**, not the content of the program or the management of students.

Prepare appropriate drawings, sketches, plans, photographs, or descriptions that will help you present your ideas for reorganizing and/or replanning the laboratory.

VOCATIONAL LABORATORY OBSERVATION CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a component was not applicable to the particular laboratory you are visiting, place an X in the N/A box.

Name _____

Date _____

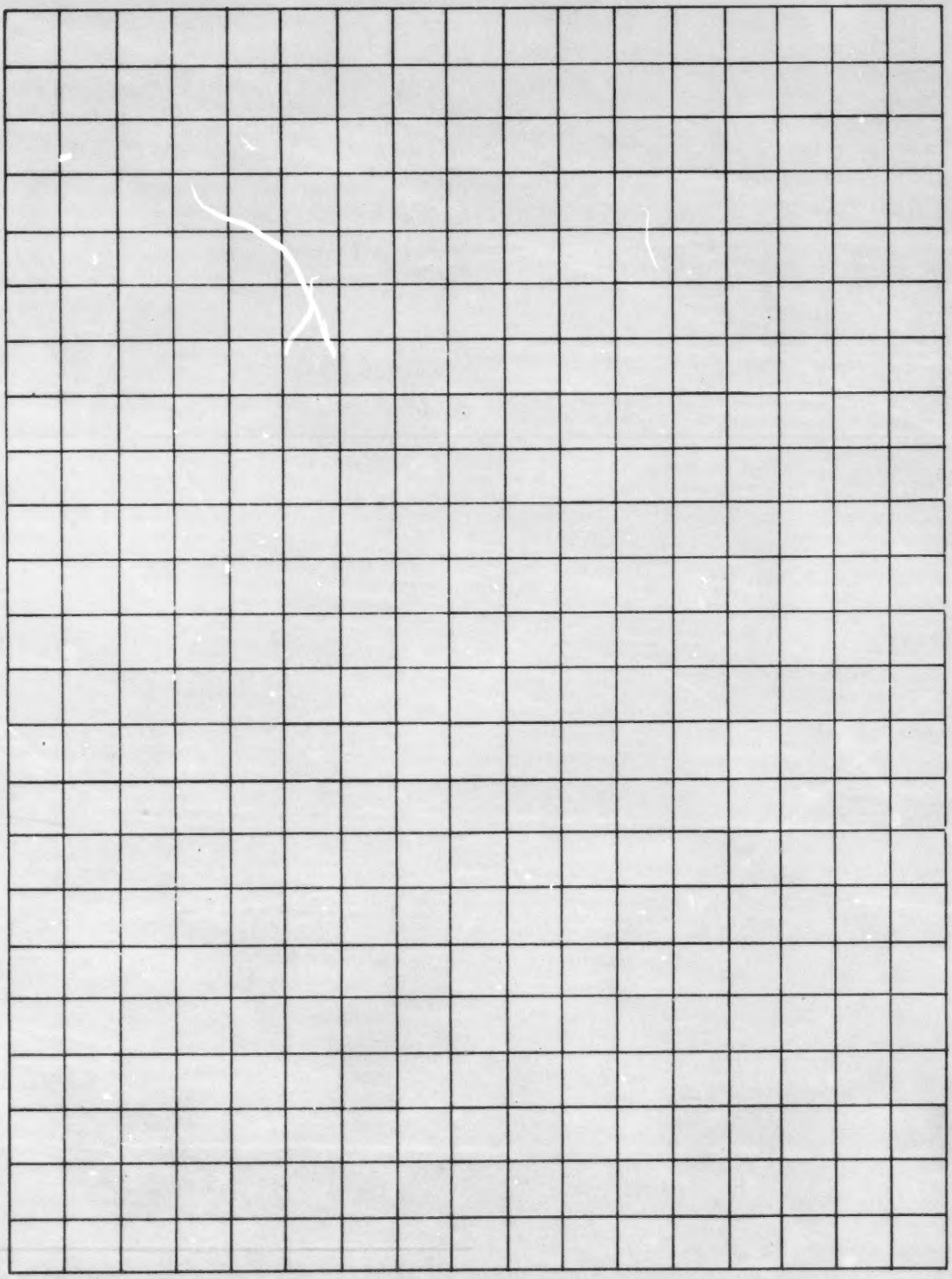
Resource Person _____

	LEVEL OF PERFORMANCE			
	N/A	No	Partial	Full
1. Each student is provided with a work area:				
a. of adequate size	☐	☐	☐	
b. appropriate to the laboratory activities	☐	☐	☐	
c. equipped with needed tools or instruments	☐	☐	☐	
2. Each student is provided with storage space:				
a. for personal effects	☐	☐	☐	
b. for projects and unfinished work	☐	☐	☐	
3. The laboratory floor space meets the recommended size for the occupational service area	☐	☐	☐	
4. Storage for laboratory equipment and supplies:				
a. is adequate in size	☐	☐	☐	
b. is suitable for the materials to be stored	☐	☐	☐	
c. meets safety standards for hazardous materials	☐	☐	☐	
5. Storage for customer work:				
a. is adequate in size	☐	☐	☐	
b. provides needed security	☐	☐	☐	
6. The arrangement of the major pieces of equipment in the laboratory:				
a. allows for sufficient working area around each piece	☐	☐	☐	
b. permits quick and easy access by the teacher	☐	☐	☐	
c. permits the teacher to monitor student laboratory activities at all times	☐	☐	☐	
d. provides traffic lanes for people and materials	☐	☐	☐	

	N/A	No	Partial	Full
7. The working environment of the laboratory:				
a. provides adequate general ventilation	☐	☐	☐	☐
b. provides special ventilation for problems of smoke, noxious fumes, etc.	☐	☐	☐	☐
c. maintains a healthful temperature	☐	☐	☐	☐
8. The illumination in the laboratory:				
a. is adequate for general work	☐	☐	☐	☐
b. provides recommended lighting for special tasks	☐	☐	☐	☐
9. Sound control:				
a. is maintained at safe levels	☐	☐	☐	☐
b. permits instruction to be given without difficulty or interference	☐	☐	☐	☐
10. There are areas within the laboratory for:				
a. individual study or instruction	☐	☐	☐	☐
b. small-group instruction	☐	☐	☐	☐
c. class instruction	☐	☐	☐	☐
11. An attractive and suitable waiting area is provided for customers and/or clients	☐	☐	☐	☐
12. Appropriate occupational conditions and standards are simulated as closely as possible	☐	☐	☐	☐
13. Appropriate media facilities are provided:				
a. for individual students	☐	☐	☐	☐
b. for the total class	☐	☐	☐	☐
14. A convenient teacher's station is provided within the laboratory	☐	☐	☐	☐
15. Bulletin board and exhibit areas are provided in the laboratory	☐	☐	☐	☐
16. _____	☐	☐	☐	☐
17. _____	☐	☐	☐	☐
18. _____	☐	☐	☐	☐
19. _____	☐	☐	☐	☐
20. _____	☐	☐	☐	☐

For creative and up-to-date ideas concerning the organization of vocational education laboratories in your specific vocational service area, refer to the journals and periodicals serving your field. You may find it useful to browse through the issues of the last year or two, looking not only at the formal articles on the subject of laboratory planning, but also advertisements for laboratory equipment. Some vocational periodicals have annual planning issues that are particularly valuable (e.g., the April issues of *Industrial Education*).

After you have evaluated the vocational laboratory and developed plans for its improvement, arrange to have your resource person review and evaluate your work. Give him/her the Laboratory Planning Checklist, pp. 35–36, to use in evaluating your work.



LABORATORY PLANNING CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following performance components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

	LEVEL OF PERFORMANCE			
	N/A	No	Partial	Full
In evaluating the laboratory, the teacher:				
1. evaluated all the appropriate areas of the laboratory	☐	☐	☐	☐
2. applied general principles of laboratory planning and organization to the specific situation	☐	☐	☐	☐
3. accurately identified the important characteristics and major deficiencies of the laboratory	☐	☐	☐	☐
4. dealt only with laboratory facility planning and organization, rather than with management	☐	☐	☐	☐
The teacher's recommendations and plans for the improvement of the laboratory:				
5. corrected all the major deficiencies identified in the laboratory	☐	☐	☐	☐
6. were feasible and practical in application	☐	☐	☐	☐
7. were realistic in terms of the actual laboratory situation	☐	☐	☐	☐
8. were in keeping with the goals and objectives of the vocational education program	☐	☐	☐	☐
9. were presented in a well-organized, clear, and readable form	☐	☐	☐	☐
10. made adequate provision for:				
a. individual and group instruction	☐	☐	☐	☐
b. materials and equipment storage	☐	☐	☐	☐
c. safe handling of hazardous materials and processes	☐	☐	☐	☐
d. student traffic lanes	☐	☐	☐	☐
e. student work stations	☐	☐	☐	☐
f. efficient operation of equipment	☐	☐	☐	☐
g. special environmental requirements of the occupational technology	☐	☐	☐	☐

Level of Performance: All items must receive FULL or N/A responses. If any item receives a NO or PARTIAL response, the teacher and resource person should meet to determine what additional activities the teacher needs to complete in order to reach competency in the weak area(s).

Learning Experience III

FINAL EXPERIENCE

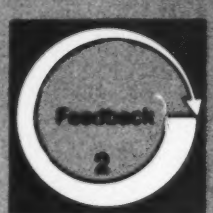
In an actual teaching situation*, organize the vocational laboratory.

As you conduct your teaching activities, organize the vocational laboratory for which you are responsible. This will include—

- collecting information about the organization of the existing vocational laboratory
- evaluating the design and organization of the laboratory
- devising a plan for improving the vocational laboratory
- implementing your plan for improvement

NOTE: Due to the nature of this experience, you will need to have access to an actual teaching situation over an extended period of time (e.g., four to six weeks).

As you complete each of the above activities, document your actions (in writing, on tape, through a log) for assessment purposes. If you were unable to implement any of the items in your plan at this time, document the reasons why each item was not implemented.

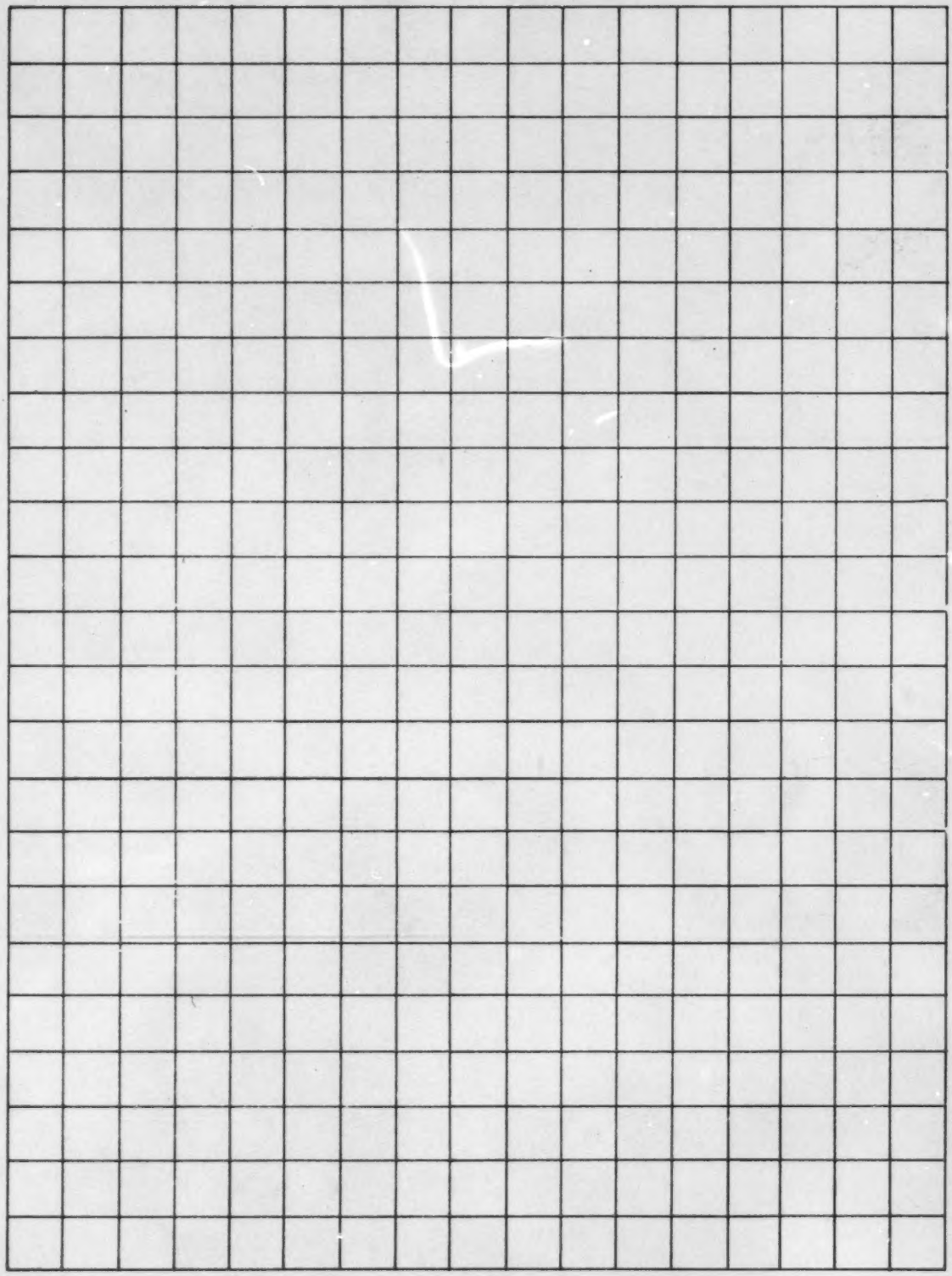


Arrange to have your resource person (1) review your documentation and your plan and (2) visit your vocational laboratory after you have organized or reorganized the facility according to your plan.

Your total competence will be assessed by your resource person, using the Teacher Performance Assessment Form, pp. 39–40.

Based upon the criteria specified in this assessment instrument, your resource person will determine whether you are competent in organizing a vocational laboratory.

*For a definition of "actual teaching situation," see the inside back cover.



TEACHER PERFORMANCE ASSESSMENT FORM

Organize the Vocational Laboratory (E–8)

Name _____

Date _____

Resource Person _____

Directions: Indicate the level of the teacher's accomplishment by placing an X in the appropriate box under the LEVEL OF PERFORMANCE heading. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

	LEVEL OF PERFORMANCE					
	N/A	None	Poor	Fair	Good	Excellent
In evaluating and planning for the organization of the vocational education laboratory, the teacher:						
1. reviewed the broad goals and specific objectives of the program to determine their effect on the laboratory facilities	☐	☐	☐	☐		
2. reviewed student learning activities to determine their effect on the laboratory facilities	☐	☐	☐	☐		
3. reviewed instructional procedures and techniques to determine their effect on the laboratory facilities	☐	☐	☐	☐		
4. obtained recommendations on laboratory organization from the advisory committee	☐	☐	☐	☐		
5. involved students in organizing the laboratory	☐	☐	☐	☐		
6. reviewed local and national safety regulations relative to laboratory organization	☐	☐	☐	☐		
7. considered security precautions for the laboratory and its contents	☐	☐	☐	☐		
8. reviewed occupational conditions and standards to ensure that the laboratory simulates the occupational environment	☐	☐	☐	☐		
9. reviewed recommended standard specifications for laboratories in the specific vocational education area	☐	☐	☐	☐		
In organizing or reorganizing the laboratory, the teacher:						
10. provided each student with an adequate work area	☐	☐	☐	☐		
11. provided each student with storage space for laboratory work and personal effects	☐	☐	☐	☐		
12. provided adequate storage for laboratory equipment and supplies	☐	☐	☐	☐		
13. planned traffic patterns to avoid hazards and congestion	☐	☐	☐	☐		

	N/A	None	Poor	Fair	Good	Excellent
14. arranged the equipment and work stations to allow the teacher to monitor and control laboratory activities	☐	☐	☐	☐		
15. organized the laboratory to facilitate maintenance and cleanup	☐	☐	☐	☐		
16. provided for the safe handling of hazardous materials and operations	☐	☐	☐	☐		
17. provided an attractive and aesthetic environment, within the context of the occupation	☐	☐	☐	☐		
18. provided a safe and healthful working environment for students in terms of:						
a. ventilation	☐	☐	☐	☐		
b. illumination	☐	☐	☐	☐		
c. sound control	☐	☐	☐	☐		
d. temperature	☐	☐	☐	☐		
19. organized the laboratory to facilitate instruction	☐	☐	☐	☐		
20. simulated appropriate occupational conditions and standards	☐	☐	☐	☐		
21. provided an attractive and adequate waiting area for clients or customers	☐	☐	☐	☐		
22. planned for efficient and effective use of the teacher's energies	☐	☐	☐	☐		
23. arranged the facilities to allow individual, small-group, and class instruction	☐	☐	☐	☐		
24. provided study areas as well as active work areas	☐	☐	☐	☐		

Level of Performance: All items must receive N/A, GOOD, or EXCELLENT responses. If any item receives a NONE, POOR, or FAIR response, the teacher and resource person should meet to determine what additional activities the teacher needs to complete in order to reach competency in the weak area(s).

ABOUT USING THE NATIONAL CENTER'S PBTE MODULES

Organization

Each module is designed to help you gain competency in a particular skill area considered important to teaching success. A module is made up of a series of learning experiences, some providing background information, some providing practice experiences, and others combining these two functions. Completing these experiences should **enable** you to achieve the **terminal** objective in the final learning experience. The final experience in each module always requires you to demonstrate the skill in an actual teaching situation when you are an intern, a student teacher, an inservice teacher, or occupational trainer.

Procedures

Modules are designed to allow you to individualize your teacher education program. You need to take only those modules covering skills that you do not already possess. Similarly, you need not complete any learning experience within a module if you already have the skill needed to complete it. Therefore, before taking any module, you should carefully review (1) the introduction, (2) the objectives listed on p. 4, (3) the overviews preceding each learning experience, and (4) the final experience. After comparing your present needs and competencies with the information you have read in these sections, you should be ready to make one of the following decisions:

- That you do not have the competencies indicated and should complete the entire module
- That you are competent in one or more of the enabling objectives leading to the final learning experience and, thus, can omit those learning experiences
- That you are already competent in this area and are ready to complete the final learning experience in order to "test out"
- That the module is inappropriate to your needs at this time

When you are ready to complete the final learning experience **and** have access to an actual teaching situation, make the necessary arrangements with your resource person. If you do not complete the final experience successfully, meet with your resource person and arrange to (1) repeat the experience or (2) complete (or review) previous sections of the module or other related activities suggested by your resource person before attempting to repeat the final experience.

Options for recycling are also available in each of the learning experiences preceding the final experience. Any time you do not meet the minimum level of performance required to meet an objective, you and your resource person may meet to select activities to help you reach competency. This could involve (1) completing parts of the module previously skipped, (2) repeating activities, (3) reading supplementary resources or completing additional activities suggested by the resource person, (4) designing your own learning experience, or (5) completing some other activity suggested by you or your resource person.

Terminology

Actual Teaching Situation: A situation in which you are actually working with and responsible for teaching secondary or postsecondary vocational students or other occupational trainees. An intern, a student teacher, an inservice teacher, or other occupational trainer would be functioning in an actual teaching situation. If you do **not** have access to an actual teaching situation when you are taking the module, you can complete the module **up to** the final learning experience. You would then complete the final learning experience later (i.e., when you have access to an actual teaching situation).

Alternate Activity or Feedback: An item that may **substitute** for required items that, due to special circumstances, you are unable to complete.

Occupational Specialty: A specific area of preparation within a vocational service area (e.g., the service area Trade and Industrial Education includes occupational specialties such as automobile mechanics, welding, and electricity.

Optional Activity or Feedback: An item that is not required but that is designed to **supplement** and enrich the required items in a learning experience.

Resource Person: The person in charge of your educational program (e.g., the professor, instructor, administrator, instructional supervisor, cooperating/supervising/classroom teacher, or training supervisor who is guiding you in completing this module).

Student: The person who is receiving occupational instruction in a secondary, postsecondary, or other training program.

Vocational Service Area: A major vocational field: agricultural education, business and office education, marketing and distributive education, health occupations education, home economics education, industrial arts education, technical education, or trade and industrial education.

You or the Teacher/Instructor: The person who is completing the module.

Levels of Performance for Final Assessment

N/A: The criterion was not met because it was **not applicable** to the situation.

None: No attempt was made to meet the criterion, although it was relevant.

Poor: The teacher is unable to perform this skill or has only **very limited ability** to perform it.

Fair: The teacher is unable to perform this skill in an acceptable manner but has **some ability** to perform it.

Good: The teacher is able to perform this skill in an **effective** manner.

Excellent: The teacher is able to perform this skill in a **very effective** manner.

Titles of the National Center's Performance-Based Teacher Education Modules

Category A: Program Planning, Development, and Evaluation

- A-1 Prepare for a Community Survey
- A-2 Conduct a Community Survey
- A-3 Report the Findings of a Community Survey
- A-4 Organize an Occupational Advisory Committee
- A-5 Maintain an Occupational Advisory Committee
- A-6 Develop Program Goals and Objectives
- A-7 Conduct an Occupational Analysis
- A-8 Develop a Course of Study
- A-9 Develop Long-Range Program Plans
- A-10 Conduct a Student Follow-Up Study
- A-11 Evaluate Your Vocational Program

Category B: Instructional Planning

- B-1 Determine Needs and Interests of Students
- B-2 Develop Student Performance Objectives
- B-3 Develop a Unit of Instruction
- B-4 Develop a Lesson Plan
- B-5 Select Student Instructional Materials
- B-6 Prepare Teacher-Made Instructional Materials

Category C: Instructional Execution

- C-1 Direct Field Trips
- C-2 Conduct Group Discussions, Panel Discussions, and Symposiums
- C-3 Employ Brainstorming, Buzz Group, and Question Box Techniques
- C-4 Direct Students in Instructing Other Students
- C-5 Employ Simulation Techniques
- C-6 Guide Student Study
- C-7 Direct Student Laboratory Experience
- C-8 Direct Students in Applying Problem-Solving Techniques
- C-9 Employ the Project Method
- C-10 Introduce a Lesson
- C-11 Summarize a Lesson
- C-12 Employ Oral Questioning Techniques
- C-13 Employ Reinforcement Techniques
- C-14 Provide Instruction for Slower and More Capable Learners
- C-15 Present an Illustrated Talk
- C-16 Demonstrate a Manipulative Skill
- C-17 Demonstrate a Concept or Principle
- C-18 Individualize Instruction
- C-19 Employ the Team Teaching Approach
- C-20 Use Subject Matter Experts to Present Information
- C-21 Prepare Bulletin Boards and Exhibits
- C-22 Present Information with Models, Real Objects, and Flannel Boards
- C-23 Present Information with Overhead and Opaque Materials
- C-24 Present Information with Filmstrips and Slides
- C-25 Present Information with Films
- C-26 Present Information with Audio Recordings
- C-27 Present Information with Televised and Videotaped Materials
- C-28 Employ Programmed Instruction
- C-29 Present Information with the Chalkboard and Flip Chart
- C-30 Provide for Students' Learning Styles

Category D: Instructional Evaluation

- D-1 Establish Student Performance Criteria
- D-2 Assess Student Performance: Knowledge
- D-3 Assess Student Performance: Attitudes
- D-4 Assess Student Performance: Skills
- D-5 Determine Student Grades
- D-6 Evaluate Your Instructional Effectiveness

Category E: Instructional Management

- E-1 Project Instructional Resource Needs
- E-2 Manage Your Budgeting and Reporting Responsibilities
- E-3 Arrange for Improvement of Your Vocational Facilities
- E-4 Maintain a Filing System
- E-5 Provide for Student Safety
- E-6 Provide for the First Aid Needs of Students
- E-7 Assist Students in Developing Self-Discipline
- E-8 Organize the Vocational Laboratory
- E-9 Manage the Vocational Laboratory
- E-10 Combat Problems of Student Chemical Use

Category F: Guidance

- F-1 Gather Student Data Using Formal Data-Collection Techniques
- F-2 Gather Student Data Through Personal Contacts
- F-3 Use Conferences to Help Meet Student Needs
- F-4 Provide Information on Educational and Career Opportunities
- F-5 Assist Students in Applying for Employment or Further Education

Category G: School–Community Relations

- G-1 Develop a School–Community Relations Plan for Your Vocational Program
- G-2 Give Presentations to Promote Your Vocational Program
- G-3 Develop Brochures to Promote Your Vocational Program
- G-4 Prepare Displays to Promote Your Vocational Program
- G-5 Prepare News Releases and Articles Concerning Your Vocational Program
- G-6 Arrange for Television and Radio Presentations Concerning Your Vocational Program
- G-7 Conduct an Open House
- G-8 Work with Members of the Community
- G-9 Work with State and Local Educators
- G-10 Obtain Feedback about Your Vocational Program

Category H: Vocational Student Organization

- H-1 Develop a Personal Philosophy Concerning Vocational Student Organizations
- H-2 Establish a Vocational Student Organization
- H-3 Prepare Vocational Student Organization Members for Leadership Roles
- H-4 Assist Vocational Student Organization Members in Developing and Financing a Yearly Program of Activities
- H-5 Supervise Activities of the Vocational Student Organization
- H-6 Guide Participation in Vocational Student Organization Contests

Category I: Professional Role and Development

- I-1 Keep Up to Date Professionally
- I-2 Serve Your Teaching Profession
- I-3 Develop an Active Personal Philosophy of Education
- I-4 Serve the School and Community
- I-5 Obtain a Suitable Teaching Position
- I-6 Provide Laboratory Experiences for Prospective Teachers
- I-7 Plan the Student Teaching Experience
- I-8 Supervise Student Teachers

Category J: Coordination of Cooperative Education

- J-1 Establish Guidelines for Your Cooperative Vocational Program
- J-2 Manage the Attendance, Transfers, and Terminations of Co-Op Students
- J-3 Enroll Students in Your Co-Op Program
- J-4 Secure Training Stations for Your Co-Op Program
- J-5 Place Co-Op Students on the Job
- J-6 Develop the Training Ability of On-the-Job Instructors
- J-7 Coordinate On-the-Job Instruction
- J-8 Evaluate Co-Op Students' On-the-Job Performance
- J-9 Prepare for Students' Related Instruction
- J-10 Supervise an Employer–Employee Appreciation Event

Category K: Implementing Competency-Based Education (CBE)

- K-1 Prepare Yourself for CBE
- K-2 Organize the Content for a CBE Program
- K-3 Organize Your Class and Lab to Install CBE
- K-4 Provide Instructional Materials for CBE
- K-5 Manage the Daily Routines of Your CBE Program
- K-6 Guide Your Students Through the CBE Program

Category L: Serving Students with Special/Exceptional Needs

- L-1 Prepare Yourself to Serve Exceptional Students
- L-2 Identify and Diagnose Exceptional Students
- L-3 Plan Instruction for Exceptional Students
- L-4 Provide Appropriate Instructional Materials for Exceptional Students
- L-5 Modify the Learning Environment for Exceptional Students
- L-6 Promote Peer Acceptance of Exceptional Students
- L-7 Use Instructional Techniques to Meet the Needs of Exceptional Students
- L-8 Improve Your Communication Skills
- L-9 Assess the Progress of Exceptional Students
- L-10 Counsel Exceptional Students with Personal–Social Problems
- L-11 Assist Exceptional Students in Developing Career Planning Skills
- L-12 Prepare Exceptional Students for Employability
- L-13 Promote Your Vocational Program with Exceptional Students

Category M: Assisting Students in Improving Their Basic Skills

- M-1 Assist Students in Achieving Basic Reading Skills
- M-2 Assist Students in Developing Technical Reading Skills
- M-3 Assist Students in Improving Their Writing Skills
- M-4 Assist Students in Improving Their Oral Communication Skills
- M-5 Assist Students in Improving Their Math Skills
- M-6 Assist Students in Improving Their Survival Skills

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